THE

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THE

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THE CORONATION ILLUMINATIONS.

IN spite of the decadence of sentiment and the hard matter-of-fact tendency of the present generation, there is no doubt that ancient customs and the love of pageantry die hard; and it is questionable, judging by the shadows of coming events, whether at any time during the history of this country—not excepting those periods of gorgeous celebrations of the Plantagenet and Stuart reigns—so much thought and organised preparation has been devoted to the question of decoration and illumination of the streets and public buildings as at the present time. Wholesale decorative designs by our greatest architects, artists, designers and what not are promised, and the results should eclipse anything that has ever been attempted in this country's history. It must not be forgotten that the facilities for carrying out such decorations are enormously greater than they were four centuries ago, or even 50 years ago, particularly as regards artificial illumination; and the supply of electricity, which is almost universally available, not only throughout London, but also throughout the country, and offers opportunities such as have never before existed. It may be taken for granted, therefore, that electricity will play a very prominent part in the celebrations of the 25th, 26th and 27th of June next, and the average central station engineer will have a busy as well as an anxious time. Opinions as to the desirability or otherwise of this expected demand are conflicting. No doubt, in many cases where the engineer is in the happy possession of ample spare plant, such a demand will be welcome as an additional means of bringing grist to the mill at a time when it is most needed. Unfortunately, the duration of the demand will be so short as to be comparatively unimportant as far as it will affect the finances of any undertaking, and unless spare plant is available as above referred to, it is questionable whether it will be worth while to consider the matter at all. Temporary plant might be brought into requisition, but unless contractors are exceptionally liberal, the increased revenue would not do much more than pay the cost of hire and labour of fixing and attendance.

A somewhat interesting question of law arises in connection with these illuminations. As far as we know, there is no clause in the Act or provisional orders providing for temporary supply, and the public can apparently demand a supply without specifying for what period it is required. The question is similar to that of the "stand-by" difficulty which has been ventilated so freely, and which is no doubt a serious matter for some undertakings. Doubtless upon the principle that a naked man cannot be robbed, so the engineer whose plant is full up, cannot supply more even for Coronation festivities. Perhaps the most serious point in connection with these illuminations, is the fact that a very large amount of inferior, if not positively dangerous, wiring will be executed and connected to the various distributing

systems in the Metropolis and elsewhere, and if the use of electricity is to be as extensive as appears to be anticipated, it will be practically impossible for station engineers to give even casual supervision to all the temporary wiring; the unscrupulous wiring contractor will be very much in evidence, and will reap a rich harvest for himself, and innumerable "earths" and "dead shorts" for the undertakers, to say nothing of the possibility of setting fire to his client's premises.

To expect to be able to enforce the usual wiring rules is hopeless, and any attempt to do so for this temporary work would raise a hornet's nest around the unfortunate engineer who tried to do it. That the municipal authorities, in London at any rate, realise the difficulty of insisting upon the usual standard of wiring is proved by the fact that they have, in a conference held at the Southwark Town Hall on Monday, March 3rd, agreed to a set of rules to be observed for temporary lighting during the Coronation. We give the full text below :—

CORONATION ILLUMINATIONS.

Suggested rules to be observed for temporary lighting or special illumination only.

1. Applications for temporary lighting for illuminations should be made as early as possible, stating the equivalent number of 8-C.P. lamps required or the amount of current.

2. Applications will be considered in order. The Council reserve the right to refuse applications after a safe limit to the station, sub-station, or transformer or house-lead capacity has been reached.

3. A charge of 10s. 6d. will be made for testing and connecting provided that a service line is already in the building. For a special connection to the mains the charge will be the actual cost of same, which amount will be refunded in the event of the supply being permanently adopted within three months.

Notice of testing to be given not less than three days before lighting up.

4. For the supply of current there will be a charge of 1d. per 8-C.P. lamp, or its equivalent, per night.

5. All charges in connection with temporary lighting must be paid in advance.

6. Connection can only be made subject to the above and the following wiring regulations for temporary work :—

(*a*) *Current Density.*—The maximum current allowed by the I.E.E. Rules will be approved, viz. :—

Size S.W.G.		Amperes.
18	...	4·2
17	...	4·4
16	...	6·8 &c.

(*b*) *Insulation to Earth.*—If tested in wet weather, to be such that not more than $\frac{1}{10000}$th of the whole current can leak, assuming one pole to be earthed. If tested in dry weather, to be such that not more than $\frac{1}{20000}$th of the whole current required can leak, assuming one pole to be earthed.

(*c*) *Joints* need not be soldered provided that the wires are well cleaned, that the joint is mechanically strong and well insulated with both pure rubber and black tape. (The "Britannia" form of joint is preferable.)

(*d*) Not more than 50 8-C.P. lamps are to be connected to one circuit, and each circuit is to be brought direct to the temporary switchboard and there controlled by a single-pole switch and fuse in each conductor. No other fuses are to be used.

(*e*) Temporary leads are to be secured at points not exceeding one yard apart either by wood cleats or binding to insulators.

(*f*) A temporary switchboard is to be fixed close to the supply service. The board should be of hard wood, or of soft wood covered with sheet asbestos, and be fixed in a horizontal position on brackets like a shelf. The wires to be brought up from underneath through holes in the board, to the various switches, &c. It is important that there should be at least 3 ft. headway above the board.

(*g*) Sufficient lead must be provided to connect to the supply service.

(*h*) If any temporary wires are connected in any other manner than provided by these rules, the ordinary wiring rules will be enforced.

7. In general, it may be pointed out that the whole decoration should be regarded from the fire point of view. The amount of inflammable material, including electric light wires, should be kept as low as possible. They should be as far removed as possible from the facia board or other woodwork, and well blocked out from the building.

From the above we may judge that composition was not the strong point of the individual who drafted the rules, but, nevertheless, the meaning is obvious, and it is evident that an honest attempt has been made to avoid unnecessary restrictions to supply which would be a source of irritation to public and wiring contractor alike, while, at the same time, attention is called, in Clause 7, to the necessity of taking proper precautions against fire.

As we have already hinted, it is questionable whether the Coronation illuminations, from the station engineer's point of view, will be sufficiently profitable to compensate for the additional work, worry and risk.

ELECTRICITY SUPPLY IN THE UNITED KINGDOM.

THE study of the statistical tables which we have recently placed in the hands of our readers would appear to be but a dry and unattractive occupation, to be taken up only on compulsion. Yet there is a good deal to be learnt from the analysis of such tables—the drift of engineering practice towards high or low speed engines; the fortunes of the two great classes of competitors for the electricity consumer's custom, companies and municipalities; the influence of these undertakings upon the electrical engineering industry, and manufacturing industries allied therewith, and so on. Such a research, moreover, comes very fitly with this number of the ELECTRICAL REVIEW, in which attention is directed to matters appertaining more especially to electric lighting.

It is unfortunate that it is impossible to ensure absolute accuracy and up-to-dateness in these tables, especially after they have been entirely overhauled and reorganised, as in this case; yet, in spite of errors here and there, the general drift of deductions based upon such a large number of data is not likely to be far from the truth.

To begin with, there are at least 282 electricity supply undertakings in operation, apart from about 15 companies recently formed to distribute electricity over large areas.

We include in the latter such undertakings as those of the Newcastle-on-Tyne, Midland, and Durham Companies, which are already more or less actively engaged in the performance of their lawful duties. Of the total, there are 96 companies and 186 municipalities—in the ratio, roughly, of 1 : 2. This ratio is exceeded in the provinces, where there are 77 companies to 173 municipalities, but in the County of London there are no less than 19 undertakings run by companies to 13 run by municipalities (one of these "companies," however, is really a joint committee of two others; another is an offshoot from an older one, and two others are owned by the same proprietors).

The whole capacity of the supply stations listed amounts to practically 400,000 KW.; this applies to the generating plant alone, exclusive of batteries. The average capacity of the generating stations, therefore, is nearly 1,400 KW. each —allowing for the fact that in several instances the plant is divided between two or more stations.

Taking the provinces only, the number of undertakings is 250, with nearly 300,000 KW., giving an average of about 1,200 KW. each; in London the total capacity is over 100,000 KW., or more than one-fourth of the total for the whole of the United Kingdom, and as there are 32 undertakings, the average capacity is about 3,000 KW. per station, more than double the general average.

It is interesting now to find the relative proportions of company and municipal undertakings. First, in the provinces the 77 companies own plants of about 34,000 KW., giving an average of over 440 KW. per station. Of these, there are 12 stations having a capacity over 1,000 KW., but none larger than 2,500 KW. (the Newcastle and District Company), though amongst the power distribution companies the Newcastle Electric Lighting Company exceeds this with its Wallsend station, 5,000 KW. Again, in the provinces, the Corporations, &c., to the number of 173, possess generating plant of about 260,000 KW., averaging no less than 1,500 KW. each. It will be noticed that while the municipalities number 2¼ times as many as the companies, the plant they control is nearly 8 times that of the companies, and the average size of their stations is nearly 3½ times as great. Moreover, they include 60 undertakings (nearly 70 stations) of more than 1,000 KW. capacity; eight over 5,000 KW. (Bolton, Brighton, Edinburgh, Glasgow, Leeds, Liverpool, Manchester and Salford); and four over 10,000 KW. (Edinburgh, Glasgow, Liverpool, and Manchester). The three last named are all over 19,000 KW., and Manchester leads the kingdom with nearly 30,000 KW.

Next, take London. There are 19 company undertakings, with 84,000 KW.—averaging over 4,400 KW. each, or ten times the size of the corresponding provincial stations. Of these, 13 exceed 1,000 KW., and six (Charing Cross, City of London, London Electric Supply, Metropolitan, St. James's, and Westminster) have over 5,000 KW. of plant capacity. Two of these, the City of London and the Metropolitan Companies, exceed 16,000 KW., the former leading with 18,000 KW. (moreover, all this is in one station). The Corporations number 13, with nearly 23,000 KW., or 1,770 KW. each; eight of their stations exceed 1,000 KW., the largest, however, (Hampstead) falling short of 5,000 KW.

Lastly, taking the whole of the country, there are 96 companies with plant of nearly 120,000 KW., or about 1,250 KW. each, while the municipalities number 186, with 280,000 KW., or 1,500 KW. each.

It will be seen, therefore, that while the provincial municipalities utterly swamp the companies, the Metropolitan companies go far to restore the balance, and the average sizes of their undertakings are, on the whole, not very dissimilar.

Now, whence did these various undertakers procure their plant? It is pleasing to find that the vast bulk of the plant is purely British; but 23 municipalities went abroad for all or part of their generators (90 machines), while only six companies were guilty of this proceeding (40 machines). Eight municipalities bought the whole of their generators abroad, and two the bulk; two companies bought all, the other five part, beyond our borders. Two municipalities bought all their engines abroad, three others some of them; and six companies bought some of their engines of foreigners.

The whole of the boilers, batteries and mains, we believe, are British.

The vertical high-speed engine is so far ahead of all others, that it is not worth while to take out the numbers; yet it must not be forgotten that in several instances vertical low-speed engines have been adopted for the larger units. Except in a few isolated cases, such as Leicester, Blackheath, &c., the horizontal low-speed engine is in a practically insignificant minority. We must not, however, fail to note that the high-speed steam turbine is making steady progress; at least 22 stations are equipped in part, or entirely, with this class of prime motor.

There are 91 undertakings using alternating current, as against 191 supplying direct current; but no less than 24 of the 91 supply direct current also, though in many cases this is due to the requirements of electric tramways. Out of 282 undertakings, *there are only 67 pure alternating current systems*, or less than one-fourth. Of the A.C. systems, there are eight supplying two-phase current wholly or in part, and three supplying three-phase; the latter are used entirely for transmitting energy at high pressure to motor-generators in sub-stations. Two other authorities are installing two-phase plant, and one three-phase. In no case of which we are aware (apart from power distribution undertakings) is three-phase current distributed to consumers, though two-phase current is used freely. These facts agree with our views expressed two years ago (March, 1900).

There are 56 stations supplying power for electric traction, as well as for lighting and motive power, and several others are preparing to do likewise.

The topics of frequency (which shows a marked tendency towards a standard of 50 cycles per second), supply pressure, capital outlay, public lighting, motors, systems of charging, refuse destructors, &c., are all enticing, but our analysis has probably already sufficiently taxed the patience of our readers. We, therefore, close these notes with the remark that only 76 undertakings are entirely without a battery of more or less importance; the larger stations do not greatly need their assistance, except perhaps for lighting the works independently of the generators, but we believe that the value of storage in small stations, on which we have often insisted, is very much underrated, and that the proportion of battery power will in the future be greatly increased.

MORE NOTES ON WIRING.

By FRANK BROADBENT, M.I.E.E.

If the wireman in charge of an electric contract were asked to what wiring rules he was working, he would, in the majority of cases, promptly reply "to the Phœnix."

Further questioning would probably elicit the fact that he had never seen a copy of the Phœnix rules, and had but a vague notion of their contents.

It is, perhaps, as well for his peace of mind, as for the satisfactory performance of his work, that he is not called upon to worry his head about wiring rules, but may rest assured—that is, if he is worth his salt as a wireman—that if he use the gumption with which nature has endowed him, and give the shibboleth "Phœnix rules" when questioned, that all will be well.

One of the strangest things in connection with the electrical industry is that the rules and regulations to which wiring work is *supposed* to be carried out are, in great measure, drawn up by laymen, that is, by men who are not, and do not profess to be, electricians, and have but the scrappiest knowledge of the subject, if any.

The wireman's life is "no catch," but it would not be worth living if he were to be expected to put up his work in accordance with the many conflicting rules in existence.

It speaks well for the safety of electricity that, under the circumstances, there are so very few accidents attributable to it, either from fire or shock.

How rarely do we see a fire office inspector on an electrical installation.

It is safe to say that with one or two exceptions there is practically no expert inspection of electrical work on behalf of the fire offices.

Even this is a better state of things than that obtaining in Canada, if a writer in the *Canadian Electrical News* is to be believed. Speaking of the insurance companies, he says, "Usually, they omit the expert and his expense, and will send one of their own inspectors from the clerical staff in the office, who has graduated from licking postage stamps, and this inspector will pass some of the most dangerous electrical connections as being perfect, and assures his client that all is satisfactory."

The usual course in this country is for the insurance company to send to the contractor a printed list of questions, the answers to which are to be filled in on completion of the work. This form is frequently filled in by an assistant in the engineer's office, who may never have seen the installation, and is then signed by an official who adds the saving remark, "we accept no responsibility."

After all, this is a mere matter of form, and the time is not far off, when even this will be dispensed with in the case of simple house lighting work, and the insurance companies will accept the risk without question, as they now accept gas-piping work.

But from the contractor's point of view, this does not end the matter; the multiplication of public lighting stations means a corresponding increase in the number and variety of wiring rules, rules which the engineer in charge for the time being seeks to enforce.

There is no doubt that a higher standard of work is essential on installations connected to public supply mains than would be necessary on an isolated installation, nor can it be denied that the standard of wiring work has been raised by the action of station engineers in inspecting and testing wiring work before connecting it up to their systems.

In very few cases has the station engineer the power to enforce his rules. The most he can do is to refuse to connect up to any premises unless he is satisfied that such connection "would not cause a leakage exceeding $\frac{1}{10000}$th part of the maximum supply current to the premises."

To put it on the lowest grounds, it is perfectly natural that for his own sake, a station engineer should object to inferior work being connected to his mains, and in the absence of any standard set of recognised rules, should draw up a set of his own; but the proposal to permit any and every engineer to formulate and enforce his own rules should be opposed on principle. A standard set of rules is urgently needed, a set which should meet the requirements of the insurance companies, the supply authorities and the B. of T.

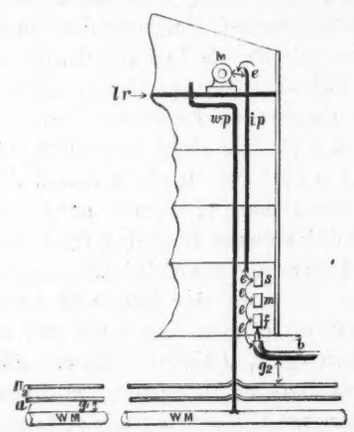
Electrical fires are now of comparatively rare occurrence, and are perhaps more frequent in the States than in this country, notwithstanding the rigid rules of the National Board of Fire Underwriters. The following are a few of the principal causes given in the last quarterly report of the above:—A cross between the primary and secondary wires of a transformer; the arcing of high tension switches; the use of motor starters without automatic release. Two recent fires which came under the writer's notice were caused (*a*) by a cross between a telephone wire and a trolley wire, which caused the partial burning out of a telephone box; and (*b*) arcing behind matchboarding, due to the severance of a wire by a screw. A safety fuse was, of course, no protection in the latter case.

When switches, fuses, ceiling roses, lampholders, &c., were made up on wood bases, when red fibre was used as an insulator, when joints were covered with gutta-percha tissue, fires were relatively more numerous. Not that any of these things are inherently bad under all conditions, but because under certain circumstances they may become sources of danger, it is well that such materials as slate, marble and porcelain have superseded them.

Many a time, in the old days of lighting the Metropolitan and District underground stations, has the writer been telegraphed for to "Come and put out the fire" at St. Mary's, or Cannon Street, or one of the other stations; fires caused by the arcing over of a D.P. fuse, by the overheating of a cable that had become thinned down by electrolysis, by the burning out of a wooden switch or lampholder, and from many other causes that nowadays would be classed as bad work.

Bad work is in these days rarely put up by a competent wireman or responsible contractor. There is, however, a species of jerry wiring carried out by the "mushroom" electrician which cannot be dealt with by wiring rules, but only by some system of registration or inspection.

Wiring is surely as important as plumbing, and if a "registered plumber," why not a "registered wireman?"



How an Electric Fire was caused.

The "mushroom" electrician often swells out into a wiring contractor, cuts prices, and takes work from better men; gets goods on credit, which he does not pay for, and so carries on a parasitic existence at the expense of the trade.

It is somewhat disconcerting to know that an electric fire may be a result of, rather than in spite of, rules, and here is a case in point:—

In the early part of this year an explosion took place in a surface box belonging to "A" company.

Before this occurred, a sudden load was observed to come on the generating station, indicating a short circuit. There was previously a leak to earth from one main. About the same time a fire occurred in a consumer's house connected to the mains of "B" company. The supply systems were entirely distinct, yet the fire on "B" system was caused by a leak on "A" system, and was due to the methods of earthing and interior wiring, both of which were in accordance with the B. of T. requirements.

It is easy to make diagrams of hypothetical cases in which this might occur, but one would hardly conceive such a case as is shown in the diagram on the previous page, which represents what actually took place.

a_1 a_2 are the two cables of "A" company, one of which (a_1) is grounded at G_1 to the water main, W M. This represents the first leak noticed.

b is the concentric lead-covered distributor of "B" company, whose mains run throughout the greater portion of their length in bitumen.

M is a 400-volt motor on a lead floor in a consumer's premises. The interior wiring is in iron piping in accordance with B. of T. requirements. The motor frame is earthed to the iron pipe (*i.p.*), which, in turn, is earthed through the metal cases of the switch, meter and fuse, *s*, *m* and *f*, to the lead covering of the concentric cable. The earthing conductor is a 7/18 vulcanised rubber-covered cable, marked (*e*).

The iron pipe passes through, and makes good contact with, the lead roof (*l.r.*), as also does the lead water pipe (*w.p.*).

Now, a_2 "grounds" at G_2; there is a rush of current in all directions. A considerable current passes down the lead sheath of *b*, through the earthing conductor, up the iron pipe, across the lead roof, down the lead water pipe, to the water main, and back to G_1. How many amperes passed through the earthing wires is not known, but the current was sufficient to burn off the insulation.

Thus a fire is caused in the premises of a consumer, *whose main switch is "off,"* by leakage from a company's mains to which he is not connected, and when his own company's mains may be perfect.

What is the moral? First, that the iron piping which is supposed to be a protection was one of the causes of the fire; and, second, that the present system of earthing is ineffective. Had the lead sheath been in metallic connection with the water main the fire would not have occurred, nor would the water main have carried any more current than it did. Again, if all water pipes, gas pipes, lead and steel sheathings, and every other underground metal conduit were connected together at frequent intervals, the leakage current in each would be so reduced that electrolysis would not be the bugbear it now is.

THE ART OF DESIGN FOR ELECTRIC ILLUMINATION; DOMESTIC AND PUBLIC.

By FRED. T. CASH.

Until a comparatively recent period, in spite of its general progress, applied art seems to have been without any apparent influence upon metal work as applicable to the decorative necessities of lamps, chandeliers or electric light fittings. With the exception of the classic styles, more particularly those of the Louis XV. and XVI. periods, all designs for lighting fixtures were distressingly uninteresting. If we refer to the types previous to, and current at, the time of the great exposition of 1851, it will readily be seen that no designer had yet appeared with a grasp of the necessary sense of beauty of either material or illuminating power employed.

Our greatest designers and artists were equally at fault with the professional designers attached to the great manufacturing houses; in fact, so little attention was paid to the designing of such articles, that only quite recently it was considered derogatory for an artist to devote his attention to the subject. With the introduction of the incandescent electric lamp, however, a new feeling of freedom came to the artist, and offered to the intelligent designer an opportunity to break through the old traditional customs. Unfortunately, however, the designer, freed from the trammels of convention, rushed into the other extreme, viz., the *naturalesque motif*, deeming such the proper treatment for the new illuminant; needless to say, such designs have gone the way of all evil things. We have but to turn over the catalogues of from 10 to 15 years ago to see what uncouth floral monstrosities even people of the best taste were compelled to purchase and possibly admire.

Precisely when a new spirit infused itself cannot be definitely fixed; probably not further back than 1880. Prior to the date just mentioned progress lay strictly along the conventional lines of the Renascence, with the Italian, French and German variations; each style in its turn was tolerated only so long as the artist and craftsman impressed the object with good sound tasteful execution. In those days detail alone constituted the only visible variation in design. This is quite an immaterial feature when the pendant is fixed in position.

Form, properly-utilised form, is, however, the essential; it is the only true basis of design. Next comes the consideration of the correct and tasteful use of the material employed, and a true recognition of the principle involved according to the nature of the light. Take, for instance, the most common metal used, viz., brass; there is hardly a more beautiful metal; scarcely one more convenient and variable in its manifold treatment; it lends itself with the utmost facility to the deft touch of the hammer or the chasing tool, and under proper manipulation takes on the various patinas and finishes as the artist may direct. Copper, iron, pewter and aluminium, all in turn, singly or in combination, lend themselves to the expression of the artist's ideas in form and colour.

The elimination of unnecessarily disfiguring detail, again, gives us the beauty of the material, and to-day our designers appear to have thoroughly grasped the larger and almost unlimited possibilities open to them. The practice of the mediæval ages would seem to have been revived, so that now in good work, labour and material seem absolutely wedded.

Fitly enough, it is to the architect we owe the great impetus which has so greatly changed our ideas; as more and more attention has been paid to the general fitments and decorations applied to our buildings, it became necessary to complete the architect's scheme with good and true lighting fixtures. True fitness in this particular lies in beautiful subservience. Light is the first essential demand upon the design, unobtrusive decorative construction is the second consideration; good workmanship with harmonious effect is the final necessity. We are in some danger to-day lest the second qualification overrides all other considerations; there is a great tendency to design for the sake of effect, regarding the lighting power as an accidental necessity that has to be tacked on at the last moment; this, however, is but a passing craze, and in due time will wear itself out to leave room for true refinement and utter fitness. Fitness of design for the surroundings in which the fixture is to be placed, is of paramount importance; the Church demands a style in accordance with its architecture. The same is equally true of large and important public buildings, and it must be borne in mind that in the selection of a design for a public building, boldness of effect, together with pleasing form, constitutes the ideal choice of the fitting. Mostly the light is at too great a distance from the eye to have intricate detail, which is wasted. To design satisfactorily for such requirements, is not the most difficult task to the artist; it is when we come to the design of fittings for domestic work that the utmost care and refinement is brought into play.

With the great variety of taste and the idiosyncrasies of individuals to consider, it is necessary for the artist to command infinite variety in his creations. The very tendency for an unlimited tax upon the designer, tends to cause degeneration in the quality of his work, unless the artist has capacity equal to all demands that may be made upon him. It is always well in the choice of fittings for a purchaser to endeavour to get into touch with the artist who can suggest the most suitable fittings, both as to material, size, and design for the various rooms which are to be illuminated.

It is rather surprising that with the number of catalogues containing the work of good men, it is still impossible to satisfy the wishes of many purchasers; it is under these circumstances that the assistance of a satisfactory designer proves of the greatest value to the community.

The fittings of, at any rate, one leading British manufacturer embody the ideas expressed above; they have been especially designed for modern domestic requirements, and the designs have been so thought out that the metal itself forms in the finished article no inconsiderable part of the decorative element. The nature of the designs necessitates

much more careful and painstaking craftsmanship than has hitherto been the case, practically every part of the fitting passing through the hands of the workmen rather than the machine. This necessary care tends to the improvement of handicraft, in itself no inconsiderable reward.

Without particularising the types of fittings suitable for the uses to which various rooms are dedicated, it remains only to say that properly chosen artistic and well-made fixtures will place the final seal upon a decorative scheme; and that where not so selected the scheme will appear incomplete, and correspondingly unsatisfactory.

We have hitherto confined our remarks to interior lighting as being the most concrete expression of modern lighting design. Public lighting is still in the hands of the Philistines, and such attempts as we have yet seen in the modern style can hardly be called successful, if we consider the St. Martin's and Embankment arc lamp columns as the best expression of modern ideas. We shall look with considerable interest, not unmixed with trepidation, to further developments along new lines. The old are undeniably hideous; the new are differently so.

But there is a far wider scope where the electric light has the whole field in front of it—viz., public illumination. Hitherto all schemes of illumination have been strictly night displays, the daylight effect being poor and inconsiderable owing to the necessary absence of all coloured fabric from the designs of set pieces. Now, however, by day or night a building can be equally effective. Up till this present year nothing of any striking originality has yet been shown, the most effective designs being of the old crystal type, converted from gas to electric illuminating power. With the absence of the danger of combustion, an immense field is at once opened to the artist who is commissioned to execute a scheme for the illumination of public buildings or thoroughfares. Flags, bannerettes, draperies, &c., are all available in close contact with the electric lamp, an impossible feature with gas or fairy lights; the steady luminosity of the electric lamp, clear or coloured, is eminently more suitable for outlining the main features of a building than the distressing flicker of gas jets, which are liable to frequent partial extinction by wind or rain.

In any scheme of public illumination worthy of the name, breadth of treatment must be secured if the scheme is to be successful. Massive colour by day and night is required, carefully distributed. This may be gained by simple drapings, trophies surmounting suitable illuminated inscriptions, or other electrical devices. The free use of the primary colours is advisable rather than the softer tones of the composite colours, as the desired effect is one which should readily come within the vision rather than be singly attracted to the eye. Consider the soft haze that pervades our London streets, how delicately it enwraps the bold and joyous colours in a diminishing perspective that half reveals and half conceals an entrancing fairyland of animated colour and of dancing form!

The old withering evergreens can now be replaced by gaily coloured artificial wreaths and flowers that are impervious to the weather. In the flowers and amongst the foliage are concealed electric lamps that illuminate the foliage as brightly as if it were day, and at night time carry the eye along the lines of buildings, balconies, &c., entwining round the capitals of such buildings as the Mansion House, Exchange, and West End clubs; these appear like lines of living colour, or by means of suitably constructed uprights they can be gathered together in canopy form, under which an allegorical group illustrating the empire might be placed.

Further, they offer a most picturesque effect swinging from side to side of the street, or forming a thick lattice work to delightfully screen some unpleasant temporary feature, such as a hoarding or necessary scaffolding. Coloured translucent balloons may be used with an electric lamp inside where it is desired to illumine a lofty cornice with more colour than from the electric lamp alone; or they may be strung in single, double or treble festoons over the front of the building, or across the street. They can be procured in any colour, and when alight disclose themselves as luminous spheres of softly-coloured radiance. The most effective use of them, however, is made by forming clusters, of any number, and hanging them pendantwise from overhead lines, arches, or other suitable positions; then they are simply delightful, as they sway about with the slightest breeze, thus lending colour and movement to the scheme in which they are embodied.

Some of the illustrations which appear on another page of this issue will show what is being done by the aid of the electric light in the nature of set pieces, which can be applied to any suitable position, and will indicate the ideas enumerated above.

In conclusion, it is most sincerely to be hoped that our City Fathers and our County Councillors will rise to the present occasion and fitly commemorate the coronation of our Sovereign in a manner worthy of the times and the materials science and civilisation have placed ready to their hands. We cannot, of course, hope to illuminate London as effectively as Paris and other Continental cities can be done. Imagine, though, the trees in Hyde Park, along Piccadilly and elsewhere, alive with twinkling points of multi-coloured light; our narrow, inconvenient and tortuous thoroughfares might also indeed be rendered beautiful. But most of all let our bridges be the foci of our energies.

The great waterway that stands for London's greatness is surely most entitled to our best endeavours. She, by nature, doubles the reward of every effort we make to beautify her; every twinkling point of life, every living spot of colour we employ is again given to us, reflected tremblingly from that broad breast which heaves and falls in sympathetic rhythm with the hopes and fears and joys of England's loyal capital.

THE OUTSIDE LABOUR QUESTION.

By JAMES WHITCHER.

We do not suppose there is a single contractor for outside work who is entirely satisfied with the way he is served by his outside labour, skilled or otherwise; at any rate, in the smaller trades. And to the majority of contractors in the electrical line, it must be a very vexatious question indeed. It is one beset with perplexities and difficulties of all kinds; and yet in the mad cut-throat competition that obtains, it is one of the most vital importance. And, in some senses, it is because of it that electrical contracting work brings no reward at all commensurate with the energy spent on it, and that so few—miserably few—contracts secured under competition show a proper balance on the right side.

Not that we are trying to put an unmerited load of the blame for this upon the shoulders of the outdoor workman. Very much of it is due to the unreasoning ambition and ignorant competition of young and foolish beginners, and adventurers in the trade; and yet more to the practices of many consulting electrical engineers, whose grand conception of their honourable profession is to act as croupier to their clients' banker in a gamble where the banker has all the game—whose sole idea of a specification is a parody of a gambling coupon, concealing quantities and risks as much as possible, and standing forth as a brutally primitive enticement to speculation. But these unfair specifications call for chapters of denunciation to themselves, and with other iniquities of consultants, they fill another story, which must be told later.

Still, however, the outdoor workman has some very serious faults; faults which, intentionally or no, cause him to be a notable antagonist to the success of his already overharrassed employer. How to remedy or combat them is one of the problems we have here to discuss.

Undoubtedly the worst and most vexatious fault is bad timekeeping, as it usually carries with it the actual and punishable crime of giving in false records of time worked. Here is a very black spot on the character of wiremen in particular; but it is too well known by all concerned to stand in any need of proof, and to the great dishonour of the men it is nearly as prevalent a disease as the trade itself; for one is almost justified in calling even the trade a disease when it carries with it—inevitably, it seems—such malignant symptoms; to the discredit, also, of the masters, who fail to take the severest possible measures to choke off the disease. For the good of the trade, every man detected in

the practice of giving false time-sheets should, without fear or favour, be promptly prosecuted for obtaining money on false pretences, and every conviction secured should be made widely known and posted up by the employers, so that the evil might be stamped out. In fact, we would earnestly advocate the sternest available measures against it, for it is taught to apprentices, and, we might almost say, is the thing most willingly taught them; sadder still to think, most willingly learnt.

Detection at first would be easy; the fraud is so openly carried out. But after a time criminal cunning would be aroused in the confirmed cases; and skilled detectives should be employed, in order to break up completely the present security in deceit.

If every employer of outside labour, where effective supervision cannot be maintained, were to adopt this course, it is to be feared that, for a time at least, our magistrates would be very busy. Yet bare justice demands it; justice, not only to his own pocket, but also to the few conscientious ones among his workmen; for there are some with consciences, which usually are made a sore burden to them. Furthermore, much good can be effected by the printing of a warning on every time-sheet issued, pointing out the punishable nature of the offence, and threatening to follow it up. Of course, on a job where the amount of labour employed can bear the expense of a reliable foreman or time-keeper, this fraudulent time-keeping can scarcely exist, unless with the connivance, or because of the negligence, of the foreman. Thus, the actual building trades are very pure in this respect, whereas allied trades, not coming directly under the supervision of the building foremen (model foremen these are, in many ways), and admitting of only small gangs of men, are at the other extreme. A good arrangement, if practicable, would be to put them all under the builder's foreman with regard to time-keeping, general conduct and discipline. Sometimes other arrangements for keeping their times can be made; where work is being done in factories or fixed works, the factory timekeeper can undertake it. But in all cases it is just as well to keep ever before these workmen the danger of false dealing, for, in the best state of affairs, the opportunities for fraud are many, and, apparently, irresistible to them.

Another fault is systematic idling; also quite too well known, but not so open to direct attack as the false time-keeping. It is universal, of course. Its practical effect is that the average working rate of many men, drawing full wages, is such that the performance can easily be surpassed by any lad or amateur with a modicum of intelligence and skill. The means by which it is achieved are many and various. Gossips, discussions, horseplay, lost items of tools and materials, frequent stomach stays and comforters, sweet musing wanderings, and so on, all serve the game very nicely, and make life pleasant amid the sordid surroundings of one's work. Even the strictest of foremen is sometimes beaten by it. He has often to compromise, in order to keep together a sufficient gang of men to get the work through. When habits are engrained in a body of men, it is hard for one man to fight against them. The result of victory must needs be the virtual banishment of the dwelling places of these habits from his sight; and that is not always a politic victory to achieve.

The one most promising and far-reaching remedy we can suggest, is a system of making every man supply faithful records of the work he has done, setting it out clearly on his time-sheet. It is in many ways a difficult rule to maintain, but, at all costs, accurate and comparable details should be insisted upon. Thus each man is compelled, independently of anyone else, to lay up the material for his ultimate advancement or undoing.

The sheets should be specially arranged to facilitate the making of these records, and a definite system of reckoning or measuring up the work adopted for each trade. It is not an easy thing to be done, but it is worth doing. The keeping of men up to their work, and the fore-knowledge in estimating of exactly what labour costs are just and reasonable, do much for the stability of a contracting trade. A considerable proportion of the gambling element is thereby eliminated, and a steadier tone given to the trading.

On many small jobs the man has practically to be his own foreman, as it were. It is, therefore, not much to require that he should report on himself. False or misleading statements of work done should, of course, be punished by instant dismissal of the offenders: it might even be possible, by adopting suitable terms of engagement, to bring such offences under the law. Even on large jobs where a foreman is employed, the system has its advantages, being in some ways a safeguard against his neglect or incompetence, and in any case stiffening his authority, by showing the men that the central authority is close behind, and therefore it is impossible to "negotiate" him. The foreman might be required to endorse each man's performance with his own opinion of it, whether good, bad, or indifferent, comments which will materially assist a firm in weeding out its bad workers and consolidating a reliable working staff.

Uncertainty of skill is another vexatious fault in the outside workman. By right there should be no doubt whatever of his skill and capacity to carry through the work entrusted to him; for the very nature of it means that he is thrown largely on his own intelligence and resources in accomplishing it. Real, unimpeachable skill within the limits of his particular work is therefore a crying necessity in the outdoor man; yet one doesn't find that the need is often well satisfied. The man good in one item of his work, is too frequently bad in the remainder. In fact, one learns in time to classify one's men into various degrees of incompetence. It is a provoking circumstance, and serious in its consequences; for over-specialising in outdoor contracts adds enormously to the cost, and the outdoor hand of to-day is far too much of a specialist. How and why he has become so is a mystery; for the ruling influences do not tend that way here as they do in the shops. Perhaps it is because of recruiting from the shops. Certain it is, the decently all-round man is disappearing everywhere, and it is a very narrow sort of skill that the average artisans of to-day possess; and as a class they appear to take no trouble to themselves to widen their range of experience. As apprentices and improvers they slur over their work, content only to do it, heedless of understanding more. Thus grow up around us bodies of men deeming themselves skilled, whom any earnest amateur, put to the mill, could easily and quickly surpass.

This deficiency is most acutely realised in outside work, where real independent skill and resource is so much to be valued. There are men who, to compensate for it, have laid up a rich store of fads and fallacies, which they treasure as trade knowledge, and exploit to excess. This mental equipment of abortions of old-time rule-of-thumb theories, without their excuse or practical worth, seems to be gathered from idle, untutored discussion, wherein the more positive and assertive man of the group is the indisputable oracle. Tenets of trade creeds thus assimilated are tenaciously held, in lieu of anything better; and they are a deadly nuisance in a man to those who have to suffer him. They make him impervious and sullen to more enlightened direction, and one chafes at the oft-time necessity of letting him go his own gait, trusting to luck to bring him through his work without absolute failure. A little knowledge of this sort is indeed a dangerous thing in a man at times, and there are jobs in which one would feel safer and happier with a labourer off the streets than with such a one. Suppression, prompt and stern, is the measure that should be meted out to the outdoor workman with promiscuous theories and ideas; for he must needs be at moments without a keeper, and mad doings may result.

A very important point in the regulation of outdoor labour, is the number of working hours allowed. Lax employers permit many more hours per week than they ought; and the workmen avail themselves rapturously of the opportunity. For many good reasons the standard working week for outside men should be somewhere about 45 hours; and all engagements ought to be definitely and expressly made on this basis. Under present conditions men grumble bitterly if restricted to less than the conventional 54 hours; and they will blithely put in 60 and 70 hours, all heedless of the fact that conditions of light and weather make work, in any sense satisfactory to the employer, impossible for a huge proportion of the time. The humble candle is invoked, and might be a Wells light for the important function it is supposed to fill. In truth, it forms a very nice focus for a

twilight gossip, and sheds its kindly rays over the simultaneous pursuit of pay and pleasure.

From 8 a.m. to 5 p.m. for five days of the week, with an hour for dinner, and 8 a.m. to 1 p.m. on Saturdays, are the effective working hours available during the winter months; and all attempts to snatch further hours from the night are terribly expensive to the employer. It is bad policy to make any difference in the *nominal* hours for the remainder of the year; but of course overtime can be more reasonably allowed. There are scores of arguments in favour of these short hours. One is the difficulty of getting in a longer period without the added time being misused. The pre-breakfast turn counts for scarcely anything; unless a very able and strict foreman be in command, and the discipline of it has been inculcated into the hands by ceaseless vigilance, as in the case of builders' men, who are seldom or never out of control of a foreman. And a start before 8 a.m. of a surety means a surreptitious breakfast or lunch; likewise a prolongation after 5 or 6 p.m. as surely means an unauthorised pause for tea. So certain is this to happen, that no excess over the standard hours should be permitted at any time, without insisting on the half-hour intervals for breakfast and tea. Again, on short hours men will, quite unconsciously, start quicker to their work and maintain it with more zest, out of weariness of inaction and desire to be doing something. Such a system is also a grateful relief of stress for foremen, staff, and "headpieces" generally. The "smart, sharp" employer will be amused at the idea of this being an advantage; he prefers opposite tactics, deeming he earns dividends thereby, but actually they are won in very despite of his error. The true managing genius knows that over-stressing himself and his staff, proves ultimately one of the greatest financial blunders he can commit.

The one objection against a short-hours system, that it cripples the usefulness of working plant, though admittedly of much consequence in a costly workshop, scarcely applies at all to outside work, where the plant charges item is comparatively small. Another objection, that it necessitates a larger staff of workmen to cope with the work, is no objection at all—rather the reverse. It is good to have adequate labour forces always at hand, prepared for emergency work, and able to act with that promptness which cheapens execution as well as encourages fresh business. The more means in reach of the managing staff, the more sure its work, and the less it is worried and strained. It is better to face a 20s. loss in the time of a workman than a 5s. loss in the time of a member of staff. The first is gross loss, anyway; the latter may grow into pounds. The most competent and best intentioned of staffs is helpless without adequate hands; and it is surely no part of its work to scheme how to do without. It is better to provide a surplus of what is the cheapest factor, comparatively, than to clog the whole machine.

The larger staff of workmen necessary with a short-hours system, is, therefore, an advantage rather than otherwise. Moreover, it provides a better selection of men for particular work—a great consideration where skill is so unequal and uncertain as it usually is. All who have to deal with small gangs of men, have often and sorely to regret having to send men on jobs for which they know them to be unfit. Once decided upon, the short-hours principle must be strictly maintained, and overtime made as rare an occurrence as possible. Overtime work in outside trades is most often of a very costly and unsatisfactory kind. Discipline is relaxed, and there prevails a great desire to husband strength and effort against the terrible strain of an extra hour or so of toil. The general result is as though the extra work had never been attempted. Of course, it is inevitable sometimes; but only the very steadiest of workers should be selected for it. The great majority are absolutely unworthy of the confidence. Likewise, work at unusual hours should be given only to men of steady plodding habits; and should be paid for at extra rates, lest they become aggrieved at having it to do.

A question to be faced is that short hours will mean a demand for higher wages rates. Be it so, there is not of necessity a loss in this. Remember we are taking the cream of the man's working day, and simply, in great measure, cutting away the time that is usually wasted. Abatement in output must not be countenanced; the rise in rates to be conditional thereon. Further, the opportunity ought to be taken to grade men more justly according to their working value. The present dead level of wages is absurd, seeing that the ranks of skilled labour contain all grades, from men scarcely better than labourers, to those really masterhands at their trades. There is urgent need of classification according to mental and manual capacities, for we repeat that nowadays the fact of a man having served his time is no guarantee of true craftsmanship. Under present conditions, skill and experience are not forced on a man, they only come to him seeking. And all are not seekers. The right to grade his employés according to their real wages value, is one to be jealously guarded by the employer, and adhered to strictly and consistently. Its application is needed, especially now, to strike a blow at the evil represented by the swelling bodies of men, content to be only nominal artisans, and falling short of the fact both in spirit and deed.

Taken thus in conjunction with an efficient system of grading wages according to competency and steadiness, a rise of wages rates can be viewed with entire equanimity. It may, in fact, be made the means to that desirable end. There is decided clashing here with trade union ideas; but that is inevitable. However kindly one may be disposed to trade organisation in theory, it is impossible to follow or acquiesce in its false principle of levelling up, or rather down. Equality is an exceedingly convenient principle to organise a trade by, but a very improper one to control it. It can only justly be applied to the case of unskilled labour, and its dominant tendency is to bring the skilled man down to this level, degrading him ultimately to the exhibition of less technical intelligence than the tools he works with. A trade union which recognised and admitted the existence of various degrees of skill and technical knowledge among its members, and co-operated with employers in classifying them, and helped generally to develop a greater earnestness of purpose in them, would be of immense service to the progress and prosperity of the trade. But as now conducted, a trade union is of little or no good for converting unsatisfactory workers into efficient ones; it simply helps them to perpetuate themselves. For the sake of simplicity of organisation, the unions encourage the excessive specialisation, which is the drawback of the skilled trades of to-day, and which the masters adopt for the sake of saving their pockets the cost of teaching their workers; thus artisanship is continually declining.

(*To be concluded.*)

ELECTRIC WIRING METHODS OF TO-DAY.

With Particular Reference to Conduit Systems.

By FRED. BATHURST, A.M.I.E.E.

Nearly seven years ago, in 1895, I suggested that Herbert Spencer's description of the principle of evolution would be particularly applicable to the electric wiring industry. Those were the good old wood-casing days, and I likened the industry to the first stage of evolutionary progress—"the unanimity of the ignorant"—for many were the conservative "jog-along" engineers and contractors who wished to be left to carry out wiring as they had always done it—that was as a wood-casing system. Of course, the wiring work *they* had been connected with had always been well done, and from their experience they claimed that wood-casing was amply efficient for the purpose, and that no substitute need be introduced or new-fangled ideas adopted. Incidentally, I remember that when I first talked "conduit" to a much feared, if less revered, luminary of the electrical insurance world, he twitted me in his "everything must be to the satisfaction of the fire inspector" kind of way, and asked why the word "conduit" should be used at all; for, said he, we have known iron, water, and other kinds of "pipes" for years, and why not call it just plain "piping"?

Change and progress in the electrical business is irresistible, and to-day, although we can only be considered in the second stage of evolution—"the disagreement of the inquiring"—the word "conduit" has become as compre-

hensive and general, as describing the method of wiring now adopted, for one and any of the various forms of electrical ducts, pipes, or tubes now before the trade, as has the use of such material itself. If the newly coined word "Armorduct" should in future become equally general and colloquial, as indicating and describing a specially made form of pipe or conduit for electrical use, I shall have no need to fear the tribulation that common saying assigns to a prophet—being without honour in his own country.

The publication of this special number of the Electrical Review presents an opportune moment for briefly noting the "whitherwards" and trend of electric wiring practice, for, within the next few months, the approaching Coronation festivities will see the night, equally as the daytime, turned into continued brightness by means of electric lighting applications, but the various temporary methods of wiring that will be adopted may have permanent effect in directing and influencing future progress. The wiring contractor in every town should seize this unique business chance, to impress upon the general public the immense possibilities that electricity has over all rival illuminants in respect to safety, ease, and the adaptability with which it lends itself to effective and artistic illumination. If the occasion is properly catered for by both supply station engineer and contractor, the impetus given to electric wiring progress will be felt for many years to come.

Such an impetus is at the moment specially welcome, inasmuch as, during the last few years, some of the trade branches of the electric lighting industry have not enjoyed profit commensurate with the general business development. Internal competition between the many outside firms taking up electric lighting is beginning to re-act injuriously. "Cut-price" work may arise from the inherent difficulty of closely estimating the labour required for different classes of wiring construction work, but the real problem before the industry is how to *reduce* the initial cost of wiring, so that good, safe and permanent work can be done at a *cost per light* that the general public is called upon to pay in connection with competitive illuminants, such as, for instance, gas supply.

Our general position is, that the majority of those customers who can afford to pay a high initial cost for electric wiring have now been supplied, and the electric wiring contractor, in catering for the more extensive field which has now to be found amongst the middle-class public, finds it increasingly difficult to obtain the price he has formerly asked; that is to say, those now wanting electric light demand lower-cost wiring—in fact, they do not want to pay more for conduiting and wiring their premises for the application of electricity than they pay for the piping system for a gas supply.

It is just at this point that the pinch is being felt, and this condition of affairs must steadily increase as the larger electric lighting field becomes covered. Now the price of wiring can be reduced according to the nature and quality of the material—such as insulated wire or conduit—being used, and by the class of labour or construction being employed. Under the present wiring principle—requiring that two insulated conductors, the lead and return, must be employed within some form of protecting duct—it is a commercial impossibility to compete with the lighting equipment—a simple pipe—the gas man has to erect. On the other hand, we have the assurance of the station engineers, that if the electric light customers they connect have "demand" enough, the station is able to supply electricity to them at a cheaper rate per unit than the gas people can supply the equivalent cubic feet of gas for. This inducement, however, is only of benefit to the few *large* consumers, and does not appeal to the very large possible number of small consumers. It is obvious, therefore, that when the initial cost of wiring is made more nearly competitive with the cost of gas pipe, electricity will always secure the preference, if not so much in respect to its burning cost, at least in respect to its superiority in use.

How is the electric wiring trade to meet this "low first cost" requirement?

To-day the insurance companies tacitly allow the use of many grades of conduit protection, whether of iron, brass, or as a lead covering on insulated wires. They do, however, practically fix the quality of the insulation of the wire used, although having very little control over the nature and quality of the workmanship under which the wiring systems are installed. Conduit material came into use mainly on its merits, for 100 ft. of conduit costs considerably more than the equivalent of wood-casing, and the contractor who uses conduit only decides to pay this extra cost, because he finds that in so doing he can save on the cost of labour of erection. He further finds that the extra mechanical protection given by a substantial conduit is well worth having, in his own interest as well as that of his customer.

The mistake, or to put it less argumentatively, the difficulty arising to-day, is that the proper mean of mechanical protection cannot be obtained for the lower-priced wiring work which has to be done. If the insurance companies would insist on a standard grade of constructive protection as firmly as they adhere to a certain quality of insulation, a marked improvement would at once take place in wiring work, and the writer would hazard the remark that once a uniform standard of mechanical protection is ensured, it would be found possible to considerably lower the insulation standard, *per se*, and bring out the important point that superior *mechanical protection* is in the long run cheaper, more economic and permanent than the present striving after high initial insulation resistance.

Working under the above conditions, the trade would soon recognise the commercial impossibility of using *two* insulated conductors within a conduit if we have to compete with the smaller gauge and less perfect pipe sufficient for gas piping. The pioneers of concentric wiring have sufficiently proved the principle that good electric wiring construction can be effected by employing only *one insulated* conductor, leaving the return conductor uninsulated. Again, if the uninsulated conductor is arranged around it as an "outer," other incidental advantages follow. A considerably smaller conduit can be employed for one conductor than that necessary for enclosing two conductors, and the only commercial way in which we can supply *at the same cost* the high-grade quality of pipe or conduit preferably required for electric wiring, is to reduce its necessary size below that required for gas piping. The writer believes that the standard method of wiring which will ultimately be adopted will consist of some suitable form of conduit enclosing and protecting a single inner conductor. It will, in fact, be an accessible concentric system.

When the station engineer had to meet the difficulty of the heavy initial first cost of his mains, he adopted the scientific expedient of doubling his voltage, so that at one step he doubled the actual *carrying capacity* of the copper conductors already laid. This device has given him breathing time for a short term of years, but the *dædalion daemon* of electrolytic trouble is following him up, and forcing him to devise still further improvement and less expensive methods of laying his mains.

Return conductors (of ample carrying capacity), maintained at "earth" potential, have not yet received the attention that will ultimately be bestowed upon them. Our "scientific" professors have not yet drawn the distinction between the "earthing" of a definite conductor and the old idea of the "earth" of telegraphic days. The apotheosis of the station engineer rests in his apostasy to the antique and the liberal use of a conductor rather than insulation.

Electric railway engineers have successfully fought their own battle, so that they are allowed to put uninsulated return conductors in the earth, whereby their first cost of insulation may be kept within reasonable commercial limits. When will supply station engineers decide that a bold policy in respect to earthing will also show them the straight road to commercial success?

The writer knows of no real reason why accessible concentric wiring, consisting of a bare copper wire inside an interiorly-insulated iron pipe, or if preferred, an insulated copper wire inside a suitable protecting metallic conduit, should not be at once adopted as a method of wiring equal, and in many respects superior, to that at present favoured. If the word and the influence of station engineers is given to this low cost method of wiring, no insurance authorities can stand in the way, and much of the existing difficulty in respect to the interpretation of rules will be automatically removed, whilst an immense and immediate field for development is opened up to all branches of electric lighting business.

Retracing our steps, so as to review in more detail the conduit methods followed to-day, we have observed that conduit of some form or other has been generally adopted in place of wood-casing by reason of the superior mechanical protection offered, and we at once notice that the "cost" conditions have had the effect of opening an electric market to the thinnest tube that can be made. Birmingham bedstead tube makers, for instance, having already been through their own "cheap piping" battle, have been able to seize their opportunity, and to-day we find the "Brummagem-made" close-joint piping changing its field of application, and taking to itself the glory of the designation "electric conduit." "Close-joint" is a good distinctive name to differentiate the bedstead class of tube from brazed, welded, seamless-drawn, and other types of water-tight pipes, but nowadays the seam or joint can be brought up so close that when the tube is painted black it is likely to deceive inexperienced buyers, who are liable to believe that they are obtaining a waterproof and seamless tube.

The only advantage close-joint tube should claim, that of being smooth and free from internal fins and burrs—owing to its innocence of welding—is at once lost whenever the pipe has to be bent cold on the job, as it then collapses on itself, one edge working inside and presenting a sharp razor-like edge towards the wires inside. Should the tube be bent, so that the collapse occurs on the outside curve of the bend, the contained wires may escape damage, but in practice many instances can be found where the braiding and the insulation on the wires, being drawn into the badly-bent tubes, has been torn off as cleanly as if it had been cut purposely with a knife. The above reason may also account for the fact that the majority of wiremen putting up close-joint tube, prefer to thread the tube on to the wire length by length, before fastening it in position. This "threadling" method of wiring cannot be called true "conduiting," for probably not one length of threadled wire in a hundred is likely to be accessible in the sense that it can be drawn out again in case of breakdown of the insulation. Those who argue they "don't want to draw wires in and out," must at least grant that a greater factor of safety is provided where true "accessibility" is insisted upon, and this can only be secured by first installing the conduit system complete in itself, and then drawing in the wires afterwards. Insurance inspectors should recognise that they have in this feature of accessibility the best possible and a thoroughly practical means of determining, with comparatively little trouble, the merit of the workmanship as well as the quality of the material employed upon any installation. With a cheap conduit, the tendency must be to employ cheap labour, with consequent liability to inferior construction. If, however, inspection meant that the contractor would be called upon to withdraw and reinsert a length of wire from any part of the installation, say, between lamp and switch or a switch and fuseboard (which would be very little trouble), such a test would ensure that good quality wire would be used throughout, and stop the practice of joining small pieces of wire together to reach through a conduit length. Further, the conduit itself would have to be carefully installed throughout, so that the wires could be readily put back again, and this would effectually checkmate the threadling wireman, over whose work and conscience there is at present very little control.

"Simplicity" of installation is certainly to be thought of, and, if possible, secured; but without a correct combination of practical and scientific ideas we may be doing things too "simply," and laying up for ourselves a store of trouble. Suppose, for instance, we admit that we are using high quality insulated wire, and placing it under fair mechanical protection as afforded by a close-joint metallic pipe, arguing that if such a conduit lets water in, it also lets it out! It then naturally follows that non-watertight coupling-sleeves, or sliding type sockets, can be advocated as saving cost of time of labour in installation. We shall thus have secured "simplicity" with a comfortable feeling as to the pocket, but how are we to reconcile such practice with the fire insurance regulations which demand that where electrical conductors are enclosed in metallic sheathing, the whole of the sheathing is to be efficiently earthed throughout? Experience early proved that a conducting material, whether employed directly as the conductor or not, must, when it is adjacent to current-carrying conductors, be treated as if it might itself become a conductor. In an ordinary conduit run there are probably from 10 to 20 joints, and it is not possible with the sliding contact between the enamelled surfaces of the conduit and sliding coupling sockets to ensure electrical conductivity throughout. Thus, a simple joint—from the workman's point of view—appears lamentably bad from that of the electrician. Such jointing can only be permitted tentatively, and should make no claim to being the "best" construction. The way out of the difficulty is to ask an increased price for the conduit, and provide sufficient thickness of metal, so that a screw thread and screwed socket can be used, for whether the tube is enamelled or not, when the ends are *firmly* screwed up into a socket, an electrically-good and watertight joint can be ensured. As soon as sufficient thickness of metal is provided for screwing purposes, it becomes possible to braze, or, preferably, weld, the longitudinal joint or seam, and thus secure a waterproof and watertight conduit system throughout. The screwed jointing socket has the further advantage of mechanical strength, and will not pull open at a bend when wires are being drawn through, even if the conduit lengths are not properly fastened up. Here again also the threadling wireman is checkmated, and a truly accessible or draw-in wiring system secured, for if the wireman tries to put up wire and screwed conduit at the same time, he will have to spend most of his time untwisting the wires, as he will twist them together when he is screwing the new length of conduit into the screwed socket on the last length. Owing to the long innings that gas has already had, there is plenty of ready trained pipe-fitting labour—labour which is already experienced, and which it is far more satisfactory to employ than the unskilled labourer who may undertake pipe fitting with sliding joints. In justification of the above criticism, it may be pointed out that those who originally advocated close-joint tube with sliding couplings, are, in their present day lists offering to supply brazed tubes of heavier gauge, with ends screwed, so that they must already recognise some demand in this direction.

As also opposed to the close joint being the simplest system, we now find that no less than *six* varieties of conduits are being listed, and that it has been found necessary, if not desirable, to work out no less than 500 varieties of fittings! These facts may be advertised as an advantage pertaining to the system, but one must feel sorry for the distracted contractor who tries to keep stock of, or to make up order lists from, such a variety of parts, and the thought arises whether a better basis cannot be secured upon which to work with scientific economy.

A philosopher would put it that "realism and idealism" must now be reconciled by the antithesis of experience.

The writer does not believe in criticising "what is" without suggesting "what may be" better practice. It is true that his own early ideal was taken at the other end of the conduit scale, and that his commercial struggles to secure recognition of the advantages of insulation-lined iron pipes have taught him that the requirements of scientific perfection must be blended to suit prevailing commercial conditions. This has now brought him to advocate a medium-grade conduit, which is designated "Armorduct," as keeping a distinction between the cheap type conduit at present favoured and the gas piping the electrical trade has to compete against.

"Armorduct" is a special quality steel tube, having a medium thickness of wall, which is welded and treated under a special process, by which it is possible to *guarantee* a perfectly smooth interior. The tube is enamelled inside and out with an insulating enamel which is moisture, acid, and alkali proof. The enamel itself is flexible, and applied in such a way that it must closely adhere to the surface of the steel for the purpose of preserving it from oxidation, rust or corrosion, which may arise from the nature of the plaster material or the building in which it may be installed. The pipe material is of such quality that all-sized pipes from $\frac{3}{8}$ in. to $1\frac{1}{2}$ in. inside diameter, can be readily bent cold by hand labour on the job without splitting the tube or chipping the enamel. The process of manufacturing "Armorduct" has been carefully worked out with a view to providing a conduit which will give thoroughly

good electrical and mechanical protection to the conductors it has to enclose. In price, and inside diameter, "Armorduct" can compete with gas-piping, and offers in addition its special points of suitability to electrical requirements. The screw-thread, standard for gas pipe, can be cut upon it, but a special thread, designed to better meet electrical conditions, is recommended for use as it allows considerable labour-saving to be effected. The outside diameters of "Armorduct" conduits are the same as those adopted for standard gas piping, so that standard gas fittings which are suitable for electrical use can be worked in if desired. Elbows and Tees of the accessible—but watertight—type are used when necessary, but in ordinary work are better superseded by a new type of so-called "knock-out" box. This watertight box is of convenient diameter, about 2¼ in.—and provides space enough to take a jointing or outlet porcelain fitting, or for making an ordinary insulated joint on the wires. The cover can either be screwed or clipped on, suitable covers being provided according to the porcelain fitting used therein. It is a much improved type of box, inasmuch as it can serve either as a one, two, three, or four-way outlet; the necessary hole is knocked out of the side as required by a sharp blow from a hammer, provision being specially made that the metal at the outlet points is sufficiently thinned down. This design of box saves the stocking of the four distinct types hitherto necessary, as it will serve for one or all uses. Ordinarily, the conduit is slipped through the hole knocked out, and clamped securely in position by screwed locknuts on either side, or the hole made can be readily tapped on the job, so that a pipe or reducing bushing can be screwed in as well as locknutted, and thus perfect electrical continuity is secured throughout the piping and fittings.

As each length of conduit is sent out screwed, in ordinary cases the amount of screw-thread cutting required on the job is not very great, as the screwing only becomes necessary when the lengths of conduit have themselves to be cut to fit. Specially designed screwed tube ends are supplied, so that the wires can be brought out of "Armorduct" pipes without liability to abrasion, and these fittings are equally suitable for use in the holes of the boxes themselves. As a matter of fact, all the generally-used fittings have been designed to fill two or more applications—for instance, one porcelain base serves for the make-up of the four or five outlet fittings, fuse, switch, wallplug, or ceiling rose ordinarily required, and a complete piping system can be installed with a minimum number of parts—conduit, socket, box, cover, tube end, and porcelain base being the few standard parts absolutely necessary.

The full details of the "Armorduct" system of wiring will be brought to the general notice of the trade in due time, and it is here referred to, not as offering *the* solution to the wiring question as to cost, but to point out that it is possible to give thoroughly good conduit construction at a price but little higher than that prevailing for the cheap work now being done, which is open to considerable criticism. The prevalence and growth of the present cheap conduiting will not assist the development of wiring progress, and the effort of to-day should be to raise the standard of wiring work, so that it can serve for the present two-wire application, and at the same time be good enough to turn over to one-wire concentric work, as soon as the supply station engineers find themselves seriously put to it, to seek that possible extension, and what will eventually be their full sphere of application, the supply of electricity for lighting to *every* lighting point at which gas is at present being used.

CORRESPONDENCE.

Lamps for Coronation Illuminations.

I have an idea of purchasing some of the translucent busts of their Majesties the King and Queen, but as they will not be required until the long evenings are upon us, I shall have no need to light them up for more than one hour during the night, as the inhabitants of the little town in which I reside go early to rest.

Now current for this short period will cost me 7d. per unit, and I have been thinking that by the use of Crawford-Voelker lamps I might make a considerable reduction in my electricity bill, as they are said to take less current than others on the market.

Perhaps, if your tests on these lamps are completed, you will be so good as to inform me whether this is correct. If so, there are doubtless many others, besides myself, who would gladly economise at a time when one's expenses are likely to be heavier than ever.

A. C. R.

April 1st, 1902.

[It is true that the Crawford-Voelker lamps are said to have a very high efficiency. We regret, however, that we are not in a position to offer an opinion on the subject. Three months ago we made a proposal, published in these columns, "to carry out independent and impartial tests of the Crawford-Voelker lamps, at our own cost"; on January 17th we announced that "the proprietor of the Crawford-Voelker patents has consented to provide us with a quantity of these lamps, in accordance with our proposal for the purpose of making a thorough test of their life and efficiency." We also said, "In the meantime, we propose to refrain from further comment on previous tests," and "if the tests confirm the qualities claimed for these lamps, we shall be among the first to congratulate both the inventors and the electrical industry in general upon a decided step in advance."

We have loyally refrained from comment, in accordance with our statement; but we have not received the lamps. An extraordinary number of inquiries has come to us during the interval as to the address of the makers of the lamp, and as to the proposed tests, and we have from time to time inquired of the proprietors when we should have the lamps, receiving seemingly evasive replies.

But if a set of lamps suitable for testing cannot be furnished within a period of *three months*—well, what are we to think? We leave the solution to our readers; they need no assistance from us in order to find it.—Eds. Elec. Rev.]

Engineers' Appointments.

I herewith enclose a cutting from the *Bournemouth Visitors' Directory* of 5th inst., giving part of the proceedings of the Bournemouth Council meeting on the appropriate date, 1st inst. I am sure the account will be interesting to other station engineers who, like "Mary Jane," are trying to better themselves. The cutting certainly gives an account of what I think usually takes place when an engineer is required, although in this case a good deal of time, foolscap, and copies of testimonials are saved by appointing a man without advertising. This raises a point I should be pleased if you would answer in your legal column. I was under the impression that municipalities had to advertise for officials to fill vacancies.

I do not wish to say anything against Mr. Barber; I must congratulate him on obtaining such a nice post in the ever-green valley of England.

The only thing I regret is, that I am not on very friendly terms with some large firm of consulting engineers.

Mr. Barber is not the only man in the kingdom who has gone through tramway work, and such things are a little disappointing to those who have had experience but have not influence.

Mary Jane.

[The report will be found in our "Notes" columns.—Eds. Elec. Rev.]

Tramway Management and "Finance."

The attainment of the maximum revenue return with a minimum of expenditure is, or should be, the object of every Corporation and general manager. This object can only be attained by making a careful and systematic study of the various departments, officials, &c., catering for the greatest possible passenger traffic (due consideration always being given to the safety of the public), and conducting the management and business on a good, sound, commercial basis.

F

As regards the officials and staff, the general manager himself should be a man of wide commercial experience, should possess good executive ability, be a master of detail, be able to judge the capabilities of his staff, have some legal knowledge, and should possess the important faculty of combining judgment, tact, and diplomacy, not only in the handling of his staff of officials, and the management of his tramways, but in the more delicate proposition of dealing with complaints, accidents, &c.

If the Corporation wish to provide him with an efficient staff to carry out his responsible work, they should always endeavour to obtain the best men possible at the salary they offer, and should provide him with specialists in their several departments. In reference to his right-hand man, viz., the traffic superintendent, he should be a man well versed in the technicalities of his work, be well used to the handling and control of men, and be able at all times to successfully cope with any increased demands for traffic (which from time to time take place) providing he has the labour and rolling stock placed at his disposal.

The car-shed superintendent should not only be a good practical man, but be well versed technically in the construction and testing of motors, controllers, and all accessories on the car, and thoroughly understand the rolling stock in general. There should also be an overhead wire and construction superintendent to thoroughly inspect and maintain in good order all wires, &c., and able to competently superintend any extensions which may be required. The permanent way ought to be periodically inspected. As regards small corporation tramways, it is sometimes economical to obtain men who are fully competent to fulfil a combination of some of the duties of more than one department, but in the case of large corporation tramway systems, it is most advisable and economical to obtain competent specialists in their several departments. It will not be out of place here to state that some of the minor responsible officials should be offered and paid higher salaries in proportion to their several positions on the staff. The motor men should be very well instructed in regard to the smooth working and running of their cars, more especially when starting and stopping; this should be done gradually, which prevents undue strain on the motors and the cars themselves, also the unpleasant jolting of the passengers.

The rolling stock should be periodically overhauled, inspected, cleaned and greased (where required); with such systematic inspection, &c., the life of the car is increased, and cost of maintenance is kept low. As regards the choice of the tramcars themselves, there are different opinions; some tramway engineers and managers are in favour of the small type, and others are in favour of the large type of cars. Neither type (taken separately) fulfils the ideal; under average local conditions, generally a combination of cars of the large and small type is the most economical. For example, supposing we take popular seaside resorts; in winter, when the traffic is comparatively small, then the small type of car is the more economical, because they require less power to drive them. In summer the large type of car is the more economical because they carry the most passengers. The fact must not be lost sight of that, whereas the large type of cars require more power to drive them than the small ones, still at the same time the labour cost of running them, *i.e.*, the motorman and guard, is exactly the same. Therefore, in winter it would be false economy, under the above conditions, to run large cars comparatively empty of passengers, owing to the excess of energy used for no useful purpose; and in the summer it would be false economy to run a very quick service of small cars to cope with the large passenger traffic, because by so doing you have a big capital outlay on a large number of cars, comparatively increased labour expenses, and increased depreciation and maintenance expenses. Again, in large manufacturing or business cities, generally a combination of the large and small type of cars is the most economical, for the very obvious reason that at certain hours of the day, viz., at morning, noon and evening, there is generally a large passenger traffic which has to be met by having the large cars; again, during certain other hours of the day the passenger traffic is comparatively small, and then the small cars are the most economical. To state the proposition in a few words, there are the hours of large traffic demands suitable for the large cars, and the hours of small traffic demand suitable for the small cars, assuming, of course, that the time service of the cars is the same in each case. The question then resolves itself into what is the most economical method to follow to attain the maximum revenue returns with minimum capital outlay and expenditures, because this question affects the whole question of the power station design, size of feeders, number, size and cost of cars, extent of the staff, maintenance, labour, &c. The answer to this is to judge the local conditions, obtain some reliable data of the probable passenger traffic (from generally already existing conditions), and the probable increase; and from these data so proportion the combination of the number of each type of cars, large and small, that with the agreed-upon time service you carry the full complement of passengers at all hours of the day, with the minimum outlay of capital, labour, consumption of power, and maintenance expenses. In conclusion, I may say that there is yet another method of considerably increasing the revenue of Corporation tramways, which, up to the present time, has not been adopted by a great many Corporations in this country.

William R. Bowker.

A "Poser"!

This question is delightful. The examiner, in the first place, does not seem to regard the fact that "inductor" is a term applied to a class of dynamos first introduced by Kingdon, in which iron pieces, called "inductors," are moved to open and close magnetic circuits, and it is well that the term should be confined to that class of machine.

Perhaps as the examiner mentions "poles," we may take it that by "inductor" we are to assume that he means the "stator" of an induction motor—three-phase.

These useful terms, for which we are indebted to Prof. S. P. Thompson, "stator" and "rotor," ought to be always used in reference to induction motors to prevent confusion.

Then the 15 poles is a somewhat peculiar number of poles; an unheard-of kind of magnet is one with 15 poles; magnetic poles have hitherto been supposed to exist in pairs, so that in this machine there would be $7\frac{1}{2}$ pairs.

Probably the question refers to a machine with "15 pairs," or 30 poles. The examiner who put that question ought to spend a session at Finsbury College.

R. Kennedy.

Leeds, *April 4th*, 1902.

The speed of an induction motor is equal to the number of alternations divided by the number of poles, less the slip.

Therefore 50 ~ per second = 6,000 alternations per minute.

$$\frac{6{,}000}{15} = 400 \text{ revs. per minute;}$$

3 per cent. of this = 12.

400 − 12 = 388 revs. per minute.

E. Austin.

[This is delightful; our correspondent falls neatly into the trap. Of course, we take it to be meant for a trap; if it were a misprint it would imply very careless proof-reading. The use of traps in examinations is doubtless justifiable, as the object is to sort out those who *think* from those who don't; but why should students be puzzled by the introduction of terms not in common use, *e.g.*, the substitution of "inductor" for "stator?"—Eds. Elec. Rev.]

Voltage of Foreign Central Stations.

Can you inform me if there is any book published that will give particulars as to voltage, &c., of foreign electric light stations such as those in India, Australia, China and the Cape, &c.? If not, could you give the information in your next issue, as it would be of great value to shippers in England?

Anglo-Indian.

[A list of Colonial, &c., electricity works is given on pp. 592—599 of the "Universal Electrical Directory" (Berly's), with particulars of voltage, frequency, &c.—Eds. Elec. Rev.]

Overhead Mains.

I have been specially interested in the letter of Mr. John Roberts, borough electrical engineer of Durban, Natal, in yours of 28th ult., as the whole installation for the Durban Corporation was laid down to my specifications and estimates, I being at that time their consulting electrical engineer. The system is single-phase alternating, 2,500 volts, 62 periods, transforming to 100 and 200 volt, and, in my time, all mains were underground, concentric rubber covered and armoured, laid direct in the ground, and protected by bricks or tarred boards; arc lighting continuous-current series, 1,500 volts. Mains rubber covered, and lead sheathed. Since my time, other systems have been dovetailed in. As my firm in Durban are contractors, they have many times experienced the inconvenience of fixing the house services to suit both Corporation and consumer, as the letter of Mr. Geo. Marshall Harriss in your issue of 4th inst. anticipates. However, this, in my opinion, is but a detail. The bare wires are cheap (?) and nasty. I have had bitter experience. The difference in temperature between noon and midnight in Durban is so great that prevention of undue sag or excessive strain in the wires is impossible. The lightning is so violent (I could tell you some stirring lightning stories) that no arresters can definitely be said to "arrest" on overhead mains in either Natal or the Transvaal. The growth of trees is a constant source of annoyance. Finally, should a hurricane like that of a few years back again strike Durban, these overhead mains will be *non est*. The wind exceeded 80 miles per hour on that occasion, and held the writer fast in a corner as with a grip of iron. The poverty-struck look of the thing in a nice town like Durban—which is really the show town of South Africa, where the borough engineer is always improving in his own department—the dangers as above stated, and the very doubtful cheapness, made me very sad when I saw these mains being erected. About the incandescent street lighting the less said the better. All the main streets are lighted by continuous current arcs in series, fitted on handsome iron poles, under the original scheme; and the contrast between this lighting and the dark tunnel of the Berea Road leading to the main residential districts is very marked and, at the same time, painful. My idea for the suburban street lighting was by series enclosed alternating arcs run from special regulating transformers with movable cores. The mains would be exceedingly cheap and permanent, and not in cast-iron pipes (as I should have mentioned the continuous current arcs now are), but in the ground direct, as the house lighting mains are. For the suburban house lighting, my idea was by three-wire transmission at 440 volts on the outers by triple underground mains; the high tension feeders supplying the house mains at small brick-built overground transformer houses, placed at varying distances from half-mile to one mile apart depending upon the load. The transformer boxes Mr. Roberts has got are very good. The difficulty he seemed to fear in adopting underground mains was the length of house services on the Berea, as the houses lay back a fair distance, as a rule, from the road, but I found that almost everyone was willing to pay a fair charge extra for an underground connection sooner than have an overhead wire spoiling the look of his property, and the Corporation could have made this charge both low and an annual payment.

As I have every wish to see Durban go ahead and flourish, I sincerely hope those of your readers with any experience on this question will give Mr. Roberts their ideas as to bare overhead mains. I am afraid he may think I am prejudiced, although nothing is further from my thoughts.

Fred. H. Hadfield, M.I.E.E., M.S.A.

London, *April 5th*, 1902.

Electric Kitchen Cars.

Referring to a paragraph in your "Electromobile Notes" on the 4th inst., headed "Electric Kitchen Cars," I notice you say that the Distributing Kitchens, Limited, are *inaugurating* a service of electric kitchen cars. I should like to point out that the company has already been running a constant service of dinner deliveries throughout the entire winter, utilising one of my company's delivery wagons supplied for the purpose.

The service has given great satisfaction, no failure to deliver up to time having occurred on any single occasion during the term of contract, which says much for the reliability of the electric car.

The Distributing Kitchens are so well satisfied with the system, that they propose shortly to put a large number of these cars on similar service.

Theodore G. Chambers,
Managing Director,
The British Electromobile Company, Ltd.

500-Volt Electric Shocks.

I must still maintain—and I am supported by the opinions of my friends, some of whom have had many years' practical experience—that it is quite possible to receive shocks and burns, sometimes with fatal results, from a 500-volt circuit.

As mentioned in my previous letter, I have received three severe shocks and burns by making only light and momentary contact with the conductor. On each occasion I was in a semi-conscious condition for several minutes afterwards.

My friends also have received shocks with the same results; and I have spoken to men who have been badly burnt and rendered unconscious by grasping a live conductor and making a good earth with their feet. Further, Sir, the fact remains that both men and horses *have* been killed by shock from a broken trolley wire.

If my memory serves me correctly, such an accident occurred in Liverpool last year.

In your current issue Mr. Ingram states that he has on two or three occasions grasped the conductor and rail without experiencing any serious results. May I suggest that he has omitted to tell us that he was wearing at the time a thick pair of woollen or other gloves.

I am not a timid subject, but I always treat 500-volt circuits with the greatest respect, for I know that they punish undue familiarity swiftly and severely.

Albert E. Vezey, A.M.I.M.E.

London, *April 7th*, 1902.

The Testing and Management of Electric Motors.

I shall refer to the method of testing advocated by Mr. Poole in the concluding article of the series. I take this opportunity of thanking him for the more courteous tone of his last letter, and can assure him that what I have said in regard to hint No. 7 is true. I further pointed out in the following article, that an ammeter reading of a 4-H.P. motor overloaded to 80 per cent. of its rated power would be by no means the same as a 10-H.P. motor under the same conditions. Those articles were "set up" two months before his criticism appeared.

The effect of weakening a motor field, or of raising the brushes of a running motor, does not call for further comment as I see Mr. Poole is in agreement with me. With regard to the latter operation, it will be seen from the article, that I do not recommend it being done unless under exceptional circumstances, simply because it is likely to result in injury to the commutator.

Mr. Dix has kindly pointed out my omission of "$- w$" in a previous equation. This was so evident a slip of the pen as to render its special correction unnecessary. The equation, and the method of testing referred to, are by no means new. They were known to the writer upwards of ten years ago. They will of necessity occur to anyone finding what value of C gives to W its greatest value. Mr. Dix employs the calculus and finds, correctly, W at a maximum when $C = \frac{E}{2r}$, or the current reduced to half its original value.

I do not intend to trespass further on your space in connection with above subject.

P. T. White.

CURRENT SPECIFICATIONS.

XCVII.—SYDNEY ELECTRIC LIGHTING.

SUMMARY.

Extent of Contract.—Supply, delivery, and erection of boilers, condensers, steam alternators, pipework, motor-generators, transformers, switchboards, &c., required for the electric lighting of Sydney.

System Employed.—Three-phase alternators, generating and transmitting electric energy at 5,200 volts to five sub-stations, will be employed. At two of these stations, motor-generators will be installed, the energy being distributed by means of a three-wire direct current network. At the other three stations, transformers will reduce the pressure so that energy is distributed on the three-phase system with 240 volts between outer conductor and earthed middle wire.

Ultimate Size of Station.—The station is designed to contain ultimately 25,000 I.H.P.

Present Instalment.—2,500 I.H.P.

Boilers.—Five to be installed of the water-tube type, each capable of evaporating 10,000 lbs. of water per hour, when fired with small coal by means of mechanical stokers.

Working Pressure.—160 lbs. per sq. in.

Mechanical Stokers.—The sum of £1,500 to be allowed in tender for this item.

Fuel Economiser.—To be of Green's latest improved pattern, fitted with 576 tubes, the scrapers being driven by means of a three-phase electric motor.

Superheater.—One separately fixed superheater to be provided capable of giving any amount of superheat up to 100° F. to 60,000 lbs. of steam per hour at 160 lbs. pressure.

Feed Pumps.—Two to be provided of Messrs. G. & J. Weir's make, each capable of pumping 10,000 gallons of water per hour against 165 lbs. pressure.

Feed Storage Tank.—One to be supplied capable of holding 15,000 gallons, divided into two equal sections.

Condensers.—Three to be provided of the surface type, horizontal pattern, two to be capable of dealing with the exhaust steam of 600-KW. set, one with a 300-KW. set. The cooling surface allowed to be not less than 1 sq. ft. per 10 lbs. of steam condensed per hour.

Air Pumps.—To be of Edwards type, and arranged to be driven by means of three-phase motors.

Circulating Pumps.—To be of the centrifugal type of ample size for their respective sets, each to be driven by means of a three-phase motor.

Steam Alternators.—Three to be provided, two of 600-KW. size and one of 300 KW. capacity.

Type of Engines.—Alternative offers may be made: if of high-speed type, speed not to exceed 230 revolutions per minute; if of low speed, fitted with Corliss valve gear, speed not to exceed 100 revolutions per minute. In any case, if double-acting engines, must have not less than two cranks; or if single-acting, not less than three cranks.

Specified Overload.—20 *per cent.* in excess of full load for periods of one hour.

Frequency.—Not to be less than 40 ~ or more than 60 ~ per second.

Parallel Working.—Satisfactory parallel working to be guaranteed at all loads.

Governors.—An ordinary governor adjustable whilst running within 5 per cent. and capable of controlling speed within 3 per cent. between no load and full load to be provided. If full load thrown off momentary increase not to be more than 5 per cent. An emergency governor also to be provided.

Exciters.—Direct-coupled exciters to be provided, though alternative offers may be made for rope-driven exciters.

Steam Guarantees.—To be given in tender when exhausting to atmosphere and working condensing at both full and half loads.

Velocity of Steam in Pipes.—Not to exceed 5,000 ft. per minute for high pressure steam, or 4,000 ft. per minute for exhaust steam.

Velocity of Water in Feed Pipes.—Not to exceed 200 ft. per minute.

Overhead Travelling Crane.—The sum of £750 to be reserved for this item.

Storage Battery.—For generating station use, to have a capacity of 1,500 ampere-hours when discharged at rate of 200 amperes. Terminal voltage to be 105 volts.

Motor-Generators.—Five to be supplied for use in two of the sub-stations. Two to consist of 150-KW. three-phase induction motors, each direct coupled to two 75-KW. direct-current 260-volt dynamos, and three to consist of a 150-KW. three-phase induction motor, direct coupled to a direct-current 520-volt dynamo.

Speed.—Not to exceed 500 revolutions per minute.

Transformers.—To be supplied of various specified sizes, single-phase type, connected on the circuit in sets of three, so that they supply a three-phase distributing system with 240 volts between outer conductors and middle wire.

Switchboards.—A number of high and low-pressure switchboards to be provided and fixed, all as specified in detail.

Customs Dues.—Will be paid by Corporation, all other charges must be borne by contractor.

Date of Completion.—To be named in tender.

Penalty for Late Completion.—£100 per week.

Terms of Payment.—70 per cent. of value of work done and plant and material delivered on site during month. 20 per cent. on engineer's certificate of completion. 10 per cent. at end of period of maintenance.

Period of Maintenance.—Six months from date of completion.

Inspection.—All material to be inspected in this country before shipment is made to Sydney.

Arbitration Proposals.—All disputes as to cost of work done to be referred to an independent arbitrator appointed by President of Institution of Civil Engineers, disputes as to quality of work to be decided by engineers.

Date for Receipt of Tenders.—Tenders to be delivered to Messrs. Preece & Cardew, 8, Queen Anne's Gate, Westminster, S.W., not later than May 7th, 1902.

This specification has been prepared by Messrs. Preece and Cardew, the consulting engineers to the Corporation of Sydney, N.S.W. In some respects, it is the most interesting which it has been our province to comment upon in this series of articles. The details have been decided upon after personal examination of local conditions, with the result that they contain several novel features.

The area over which distribution is required is of considerable size, and the site of the generating station was not such that a direct current system, pure and simple, was desirable. Hence all the energy required will be generated three-phase at 5,200 volts pressure, and distributed at this pressure to five points in different parts of the city. At two of these, situated nearest to the centre of the city, motor-generators will be placed to supply a three-wire direct current network with 240 volts between middle and outer conductors. This will permit of direct current motors being used in the central area, and thus enable the undertaking to cultivate a motor load.

From the generating station, and also the remaining three sub-stations, a four-wire three-phase distribution system will be supplied, the lamps being balanced, as far as practicable, between the earthed middle wire of the star-connected network, and each of the three outer conductors. The lamp voltage is 240 volts, and such a system seems to be specially suitable for residential suburban areas, where the load is principally of a lighting character. This portion of the scheme resembles the much talked-of Dublin proposal, now approaching completion.

It will be noticed that, contrary to the tendency of present day practice, a separately fired superheater is demanded. This is another direction in which this may be deemed a pioneer specification, for information which has reached us from several quarters leads us to think that future practice will, to a large extent, discard the present method of combining boiler and superheater.

Although a direct current supply from the battery and spare motor-driven exciter and booster is available at the generating station, it will be observed that three-phase motors are specified for driving all the subsidiary electrically-driven machinery.

The general conditions are, on the whole, acceptable; the date o completion must be given in the tender, the penalty for non-compliance with which is £100 per week.

The terms of payment are fair, and, with regard to arbitration, while all points involving questions of cost are subject to the decision of an independent authority, all questions as to interpretation of specification and quality of materials are reserved for the final decision of the engineers. We regret this, for we feel that it is fairest to all parties when there is the possibility, if found to be necessary, of an appeal to an independent authority in *all* questions of disagreement.

BUSINESS NOTES.

"Ark" Lamps.—We understand that Messrs. Johnson and Phillips's now well-known "Ark" lamp is meeting with much approval by reason of its good burning qualities, solid, durable construction, economy in carbon consumption and trimming, and low price. Owing to its high candle-power (2,000 nominal), it is claimed to be specially suitable for Coronation decorations, and can be supplied with various ornamental cases to harmonise with the surroundings. We have before us a full set of the different circulars which have been issued by the makers; these include one containing copies of a number of excellent testimonials which have been received from electrical engineers and others who have had experience of their working. These lists may be obtained from Messrs. Johnson & Phillips on application.

The firm is turning these lamps out at the rate of about 100 per week, and keeps a large stock for immediate delivery. They can be loaned out for the Coronation, and are fitted if desired, with either pink, green, or ruby globes, instead of the ordinary alabaster or clear globes, and by a combination of these, a light is obtained closely resembling daylight.

Coronation Pins.—We have received from Mr. Archibald J. Wright, of Islington Electrical Works, 318, Upper Street, N., a list of his "Coronation" electric scarf pins, also a specimen pin. The pins have been specially designed for use during the great celebrations which are approaching. The letters "E" "R" and a crown appear on either side or on the top of the pin; the pins have insulating backs, and are fitted with terminal hooks for easy attachment of the lamp and wire. The trade can obtain numbers of Mr. Wright's descriptive circulars without name on if they apply to him.

Electrical Wares Exported.

Week ending April 9th, 1901.		Week ending April 8th, 1902.	
Adelaide	Value £42	Aarhuus. Teleg. cable ..	Value £250
,, Teleg. wire	129	Alexandria	77
Bombay	97	Amsterdam	396
Brisbane	68	Bankok	131
Calcutta	411	Buenos Ayres. Teleph. cable ..	660
Canada (*via* U.S.)	180	Calcutta	1,846
Cape Town	105	Cape Town	667
,, Teleg. mat. ..	80	,, Teleg. apprts. ..	55
Channel Islands	17	Channel Islands	783
Christiania. Teleg. mat. ..	91	Colombo	311
Colombo	190	Copenhagen. Teleg. wire ..	150
,, Teleg. mat.	54	Durban	502
Copenhagen. Teleg. wire ..	34	,, Teleg. mat.	653
Delagoa Bay	91	,, Teleph. wire	465
Durban	105	East London	1,387
East London	24	Fremantle	42
Gibraltar	158	Hamburg	52
Gothenburg. Teleg. wire ..	226	Madras	190
Hamburg	23	Malaga	53
,, Teleg. mat.	250	Melbourne	185
Hong Kong. Teleg. mat. ..	120	Pasages	338
Lyttleton	60	Perth	620
Madras	766	Piraeus	77
Malta	16	Port Elizabeth	249
,, Teleg. mat.	131	Sydney	2,534
Melbourne. Teleg. mat. ..	576		
Monte Video. Teleg. mat. ..	24		
Perth	85		
Port Elizabeth	963		
Port Said	17		
Rangoon	11		
Rouen	55		
Shanghai	422		
Singapore	222		
Stockholm. Teleg. wire ..	247		
Sydney	207		
,, Teleg. wire	1,170		
Taku. Teleg. instruments ..	108		
Trieste	32		
Vigo. Teleg. paper	252		
Yokohama	156		
,, Teleg. apparatus ..	170		
Total ..	£8,187	Total ..	£12,613

Foreign Goods Transhipped.

Durban. Telephones ..	Value £36	Calcutta. Elec. appts. ..	Value £43
		Gothenburg. Elec. apprts. ..	45
		Total	£88

Auction Sale.—Details are given in our advertisement pages to-day of an auction sale to be conducted by Messrs. P. Huddleston & Co., at Manchester, on April 17th, of a quantity of electrical apparatus, comprising 20 dynamos and motors, various switches and accessories, also cables, wires, electric light fittings and lamps, &c.

Bankruptcy Proceedings.—Mr. Sam Wells Page, Wolverhampton (Official Receiver in Bankruptcy), has issued a statement of the affairs of Lewis Bayliss, electrical accessories manufacturer, residing at Ridding Lane, Wednesbury, and carrying on business at Brunswick Park Road, as F. Terrill & Co., and at Ridding Lane in the partnership firm of Lewis Bayliss & Co.; and also carrying on business at 110, Cannon Street, London, E.C., as Cordwell & Co., and at 1 and 2, Bucklersbury, in the City of London, as the Thames Electrical Manufacturing Company. The gross liabilities of the debtor are set down at £2,273, of which £2,226, in respect of 46 unsecured creditors, is expected to rank for dividend. The assets are estimated to produce £439, made up as follows:—Stock-in-trade, £95; trade fixtures, fittings, utensils, &c., £161; 113 book debts, £460, estimated to produce £230; total, £487; from which £47 has to be deducted in respect of six preferential creditors, thus leaving £439, and a deficiency of £1,786. The bankrupt states the causes of his insolvency to be "mismanagement of the business of Cordwell & Co., and taking over the liabilities of the Thames Electrical Manufacturing Company with insufficient capital." Accompanying the statement of accounts are lengthy observations by the Official Receiver, who says that in October, 1896, the bankrupt, who is only 25 years of age, commenced business as a cycle and electrical accessories manufacturer at Walsall Street, Wednesbury, with a capital of £100. Subsequently he acquired other businesses, one of them being that of a clothier. In January, 1902, the bankrupt purchased a business known as the Thames Electrical Manufacturing Company, at 1 and 2, Bucklersbury, London. He states that an account was prepared, showing a deficiency of £50, but undertook to discharge the liabilities, which amounted to about £900. He paid £400 off at once with money he raised upon sale of or mortgage on an interest he had under his grandfather's will and the marriage settlement of his father and mother. This business was managed for him by his brother, who managed the clothing business, assisted by a Mr. E. T. Onbridge, who was a partner in the business before the bankrupt took it over. In February last the bankrupt discontinued the business, and removed the stock to Wednesbury. The unsecured creditors consist of £890 17s. 5d. in respect of the business carried on as the Thames Electrical Manufacturing Company; £564 4s. 5d. in connection with the business of Cordwell & Co.; £616 1s. 1d. in connection with the business of Terrill & Co.; and £154 14s. the bankrupt's separate debts. The Official Receiver says he does not think the assets will realise the amount they are estimated at; and he adds:—The bankrupt has not kept proper books of account, and the information he has given relating to the acquirement of the various businesses and his dealings is very vague. He appears to have taken over businesses without proper investigation, and without the slightest probability of being able to efficiently superintend or control them, and has been most rash in incurring liabilities he could not meet. He accounts for his deficiency as follows:—Loss in connection with Lewis Bayliss & Co., £400; ditto Terrill & Co., £461 3s. 4d.; ditto Thames Electrical Manufacturing Company, £743 8s. 8d.; ditto Cordwell & Co., £490 6s. 2d.; estimated loss upon enforced realisation of assets, £486 14s. 6d.; law costs, &c., £14 14s.; total, £2,596 6s. 8d. Less amount raised upon reversionary interest under father's and grandfather's wills, £400; surplus of assets over liabilities, March 12th, 1901, £410; total, £810. Present deficiency, £1,786 6s. 8d.

First meeting of creditors, April 11th, at Wolverhampton; public examination, April 17th, at Walsall.

Messrs. Lewis Bayliss & Co., of Ridding Lane, Wednesbury, state that they are in no way concerned (except as creditors) in the bankruptcy proceedings of Mr. Lewis Bayliss (trading as F. Terrill & Co., the Thames Electrical Manufacturing Company, and Cordwell & Co.). Mr. W. Sanders, the proprietor of Lewis Bayliss & Co., proposes to carry on the business in his own name, guaranteeing all future accounts.

Liquidations and Dissolutions.—The Kalgoorlie Power Syndicate, Limited, will meet at Winchester House on May 21st to hear an account of the liquidation from Messrs. H. J. Dixon and W. A. Smith, liquidators.

Notice is given in the *London Gazette* of the release of liquidator (Mr. H. de V. Brougham, of Carey Street) of the Madras Electric Tramways Company, Limited.

At meetings held at Amberley House, W.C., on March 10th and 25th, it was decided to wind up the *Tramway and Railway World* Publishing Company voluntarily, with Mr. R. A. Smithson as liquidator.

A meeting of the Nuneaton Electric Company will be held at Nuneaton on May 7th, to hear an account of the winding-up from the liquidator, Mr. H. B. Harris.

Books Received.—"Journal of the Institution of Electrical Engineers, No. 155, March, 1902." London: E. & F. N. Spon, Limited. 4s.

"Report of the U.S. Commission of Fish and Fisheries for the year ending June 30th, 1900." Washington: Government Printing Office. 1901.

"Electric Power Transmission," by L. Bell. New York: *Electrical World and Engineer.*

"The Cultivation of the Mathematical Imagination," by Mary E. Boole. Colchester: Benham & Co. 6d.

"Magnetism in Growth," by S. P. Thompson. London: Henry Frowde, 1902. 1s. net.

"The Deep-Level Mines of the Rand," by G. A. Denney. London: Crosby Lockwood & Son, 1902. 25s. net.

"The Factory and Workshops Act, 1901," by C. W. Williams and C. E. Musgrave. London: Alan Stuart, 1902. 3s. 6d. net.

"Konstruktionstafeln für den Dynamobau," by Prof. E. Arnold. Stuttgart: Ferdinand Enke, 1902. In two parts, M. 20·70 each.

Business Announcements.—Messrs. Heaton, Smith and Co. advise us that they have now begun operations in their new works, Barford Switch Works, Irwell Road, Pendleton, Manchester, to which address all communications should be sent. The new works are nearly four times the size of the former works, and are equipped in a thoroughly up-to-date manner. Everything has been so arranged as to cope with the best class of work in accessories and switchboards, and quick delivery will be guaranteed.

Mr. William Patterson, of the City Wire Works, Walker Gate, supplies patent "matchless self-lubricating" dynamo brushes.

The British Thomson-Houston Company, Limited, of Rugby, are supplying their standard Edison incandescent lamps for illumination purposes.

Mr. G. Braulik, of 217 and 218, Upper Thames Street, E.C., asks us to state that he is making special arrangements for the manufacture of all special devices, letters and crowns in incandescent lighting for the Coronation. He will also supply the standard "Philip" incandescent lamps, plain and coloured, in all voltages and candle-powers, and all varieties of shapes for illumination purposes.

Catalogues and Lists.—Messrs. Ernest Scott and Mountain, Limited, of Newcastle, are circulating a new list (March, 1902) of their compound enclosed high-speed engines and direct coupled dynamos.

Messrs. W. N. Brunton & Son, of Wire Mills, Musselburgh, have sent us a list of their special "Beacon" high resistance wire, which is used extensively for arc lighting and for dimming, &c., and will no doubt be used successfully in connection with various illuminating devices this summer. The tables state the diameter, resistance, carrying capacity and price of wires from 8 to 30 S.W.G.

Mr. Arthur Koppel, of 27, Clement's Lane, E.C., is about to bring out a new cooling-tower catalogue.

A number of lists of cranes, pulley blocks, &c., have come to hand from Messrs. Herbert Morris & Bastert, Limited, of Loughborough.

The Electrical Transmission Company, of Hammersmith, have issued a catalogue giving complete descriptions and prices of standard apparatus manufactured by them, including switchgear, motor starting switches, main switches, &c.

The Electric and Ordnance Accessories Company, Limited, will send a copy of their Section A. catalogue of electric light accessories to any member of the trade upon receipt of card.

Messrs. Bachrich & Co., of Vienna, send us a fly-sheet containing details and prices of their "Climax" automatic steam engines, which are high-speed vertical and horizontal single-cylinder open engines, of powers from 3 to 80 H.P.

Mr. William Boby, of Salisbury House, E.C., has sent us a copy of a new catalogue of his Chevalet-Boby patent heater detartariser. The method of working is explained by aid of a diagram, and a list

is given of some of the works in which the system is in use or on order.

The Langdon-Davies Electric Motor Company, Limited, are sending out new price lists of their single-phase alternate current motors notifying large reductions in prices. They are now supplying *graduated* pattern starting switches with the 9 B.H.P., and larger sizes at the inclusive price, ordinary pattern starting switches being included in the prices of the smaller motors as heretofore.

A new catalogue, pocket size, has been issued by the Cryselco, Limited, of Kempston Works, Bedford. It gives illustrations and details of motors, ceiling roses, switches, wall plugs, brackets and sundry other electrical fittings.

The Charge of Concealing Shares.—At the Guildhall on 3rd inst., before Mr. Alderman Smallman, Mr. Charles Bright, of Buenos Ayres, continued his defence, and charged certain witnesses with having given misleading evidence against him. The case was again adjourned.

Consular Reports.—*Electricity in Chile.*—Consul Austed, in a report on the trade and commerce of the consular district of Coquimbo (Chile), received at the Foreign Office on March 10th last, states that in La Serena a small electric plant has been installed to supply light for the streets and for private houses.

Fuel Oil for Electric Lighting.—Consul Vansittart, in his report on the trade and commerce of New Orleans for the year 1901, states that contracts for changing from coal to oil are being let by all of the electric light companies, by the large industries, and by steamers running between Mobile and the fruit-growing islands.

"Dialite" Wires for Temporary Wiring.—The St. Helen's Cable Company, Limited, of Warrington, are supplying their patent "Dialite" bitumen wires for temporary wiring work, such as Coronation illumination installations. Cheapness and excellence of quality are claimed for them.

Holland.—The Dutch Customs authorities have recently given a decision to the effect that dynamos and motors are dutiable as physical instruments at the rate of 5 per cent. *ad valorem*, unless at the time of importation, or subsequently thereto, it be proved by means of drawings, documents, &c., that they are intended for use as factory machinery, in which case they are duty free. Dynamos employed in a factory exclusively for lighting it (not to be confounded with central station machines) are not to be considered as factory apparatus. Under certain conditions, regulating, controlling, measuring and safety apparatus, forming part of and imported with electrical machinery, may be admitted duty free when the machinery itself is entitled to free admission.

Plant for Sale.—The Dublin United Tramways Company are offering for sale (see our advertisement pages to-day) the generating plant erected at their Clontarf and Ballsbridge depôts, as the whole system is now being operated from the Ringsend station.

Police-court Charges.—At Marlborough Street last week two men, named Spaulls and De Carli, 35, an engineer of Italian nationality, living in Greek Street, Soho, were charged with being concerned in stealing 10 coils of electric cable, worth £21, belonging to the Sun Electrical Company. Mr. Denman committed the prisoners for trial—Spaulls for stealing and De Carli for receiving.

At Bow Street, on Tuesday, one H. Bowser was charged with theft of moneys from the British Electric Traction Company while he was in their employ as cashier at £150 per annum. The deficiencies were stated at about £200. Prisoner was, according to the *Times* report, remanded on bail in two sureties of £100 each.

Underfeed Stokers.—We learn that Erith's Engineering Company, of 70, Gracechurch Street, London, have large repeat orders in hand from the Chester Corporation, from the Brymbo Steel Company, and many other concerns for their well-known Erith's underfeed stokers, which feed the coal from below by a simple plunger movement, so attaining smokeless combustion and coal economy combined with a great range of capacity. They have issued separate catalogues of their various specialities, viz., stokers, feed-water heaters and purifiers, oil and steam separators, fan-system heating apparatus, drying apparatus, fans and blowers, steam engines, pumps, &c., copies of which may be obtained on application.

ELECTRIC LIGHT AND POWER NOTES.

Barking.—The U.D.C. is to make application to the L.G.B. for sanction to the borrowing of £7,570 on the electric lighting account (in lieu of the loan of £13,400 previously mentioned) as per the engineer's estimate, as follows:—Extensions to buildings, £375; machinery, £4,712; distribution, £2,455; loan costs, &c., £28.

Bloemfontein.—A special meeting of the Town Council was lately held to consider the question of the extension of the electric lighting plant. The proposed new plant, which, it is estimated, will cost £13,650, will double the present output, allowing for a considerable reserve, and will provide, in addition to lighting, electric power for motors. There are 4 342 lights installed in private houses, each of 8-C.P., while, to illuminate the streets, 146 lights of 32 C.P. and 15 arc lamps of 1,000 C.P. are installed.

Bristol.—The City Council has considered a report in which the Sanitary Committee recommends a large increase in the street arc lighting. As stated in our issue of March 28th, the Committee proposed to provide 366 additional lamps of 1,000 C.P. each, to be kept alight all night, at an inclusive charge of £14 10s. each per annum. The Electrical Committee agreed, if the extension was approved, to reduce the charge on the existing 310 arc lamps by £2 per annum. A large number of gas lamps would be discontinued, and the net effect of the change would be £2,783. The Sanitary Committee had recently entered into an agreement with the Bristol Gas Company whereby the latter was to carry out a large installation of incandescent gas lighting at a reduced charge; but the recommendation to extend the electric lighting in the principal streets produced a letter from the Gas Company declining to carry out their agreement under conditions which would relegate them to streets of secondary importance. Their letter further suggested that electric arc lights were in practice not nearly up to their nominal standard, and that as the city would lose the benefit of the reduced cost of gas lighting, and would spend a large sum more on electric lighting, the net result would be an addition of something like £6,000 to the rates. The Council by a large majority approved of the extension of street lighting by arc lights, but left the list of streets to be decided at a future meeting.

The Electrical Committee has decided to advertise for tenders for a 210-KW. dynamo, for which provision has already been made, and to ask permission of the Council to order a 500-KW. steam turbo-dynamo.

Cambuslang.—The Lanark County Council has approved of a proposed scheme for destruction of refuse and electric lighting at Cambuslang, estimated to cost £10,000.

Canada.—There is before the Ontario Legislature a Bill to empower municipalities with over 100,000 inhabitants to purchase and distribute electrical energy for heat, light, and power. As Toronto is the only city with a population of over 100,000, it is the only place where the Act, if passed, would apply at present. The Bill is designed to give that city the right to obtain energy from Niagara Falls. It means an outlay of three or four million dollars.

Cape Colony.—The Paarl Electric Power Syndicate, Limited, intend to introduce a Bill into the Cape House of Assembly to empower them to erect power stations locally, and to generate and transmit electric energy within the limits of the municipality.

Cardiff.—At a meeting of the E.L. Committee recently, Mr. A. Ellis, electrical engineer and manager, stated that the quantity of energy generated during the past twelve months was 1,287,795 units against 917,000 units in the previous year. This increase of 40 per cent. worked out in accordance with what had been estimated throughout the year.

The tender of the British Westinghouse Company, Limited, for the supply of two 40-KW. electrical balancers was accepted at a price of £945.

An application from the Llanishen Parish Council for an extension of the Corporation electric mains to that district, where most of the houses were prepared to take electric light, and where it was intended to adopt street lighting, was referred to the Town Clerk for report.

The B. of T. has approved of the Council's application for altering the system from an alternating current to a direct current supply.

Cults.—The electricity consumers are now without a supply, the electricity works having been shut down at the end of last month in consequence of the unfortunate financial position of the company, which is in liquidation. An attempt to form a local company to carry on the supply has so far had negative results.

Dalmeny.—Lord Rosebery a year ago had the electric light introduced into Barnbougle Castle, and is so satisfied with it that he has decided to have it in Dalmeny House also. The power is to be supplied by two 25-H.P. oil engines and dynamos. There will be about 700 lamps.

Dudley.—The Electric Lighting Committee of the Corporation has decided that the hours for which the charge of 6d. per unit shall be made shall be from 7.50 to 9.30 p.m., and that the Corporation supply tested lamps at 10 per cent. on the actual cost. The Committee also recommends the Council to accept an offer by the Westinghouse Company to supply new motors for the disused machines at the generating station.

Dumfries.—The T.C. has agreed to appoint a consulting electrical engineer to furnish the Council with a preliminary report with regard to an electric lighting installation, and to specially report upon the use of gas for generating electricity. The clerk was instructed to write to the following engineers, inquiring for what fee they would furnish the report desired, viz.:—Messrs. J. and J. S. Enright; Messrs. Lacey, Clirehugh & Sillar; Prof. D. S. Capper; and Prof. Kennedy. The extended time granted for the provisional order expires in three months.

Dundee.—The machinery at the electric lighting station is inadequate for the requirements, and the T.C. is about to borrow a sum not exceeding £50,000 for extensions. The Finance Committee has resolved to apply to the Secretary for Scotland for his approval to the loan.

Durham County.—The lighting of villages adjacent to collieries by means of electricity is gradually increasing in the County of Durham, and at the last meeting of the Blaydon U.D.C. it was agreed that the Priestman Collieries Company should light Rowland's Gill, Victoria Garesfield, and Blaydon Burn; the company were also asked if they could undertake the supply of electric light for Barlow. Chopwell, in the same district, is also lighted by electricity, but in this case the energy is provided by the Consett Iron Company.

Epsom.—The U.D.C. has passed estimates for 30 automatic time switches (at about £4 each) for use with the public arc lamps already in use.

Germany.—The municipal authorities of Stuttgart have decided to purchase and take over as from April 1st, the central electric lighting station established in the town by Messrs. Schuckert and Co. The purchase price is £300,000.

Hamilton.—The selection of the site by the Corporation for Messrs. Edmundson's electricity supply station has been delayed for a while.

Hanley.—The accounts for the past year show a gross profit of £4,352 3s., out of which £2,156 6s. 1d. has been paid for interest, and £2,148 4s. 5d. for sinking fund charges, leaving a net profit of £47 12s. 6d. The sinking fund now stands at £10,167 1s. 8d. It was decided that application be made to the L.G.B. for sanction to borrow the sum of £12,000 for extension of mains and generating station, provision of coal bunkers and machinery, transformers, motors, instruments, meters, and general stores.

Ilford.—The E.L. Committee has recommended the U.D.C. to make an immediate application to the L.G.B. for authority to borrow the amount required to meet excess expenditure on the original loan, and has directed the clerk to request Mr. Hawkyne to furnish a report giving the total sum required.

India.—The Rajputana—Malwa Railway Company has decided to adopt electric light throughout the passenger service, a six months' trial of the Bombay Electric Company's system during a most trying season having proved entirely satisfactory. The trial plant has been taken over by the railway company. Government sanction for the extension is expected shortly.

Kirkby Stephen.—The North-Eastern Railway Company have arranged to put down an electric installation for the railway station and sidings at Kirkby Stephen. The contract has been entrusted to Messrs. Gilbert Gilkes & Co., Limited, hydraulic and electrical engineers, of Kendal. A steep fall which occurs in the bed of the river Eden, where it passes under the line at a point near the station, is to be utilised to work a turbine and dynamo. The current will be conveyed overhead to a large battery near the station buildings, and will be distributed to the various lights, motors, &c., through armoured underground cables. It is intended to supply all signal posts, dollypoint lights, signal cabins, station offices, waiting rooms, workshop and loco. sheds with the electric light. An electric luggage lift, capable of dealing with a weight of one ton, is to be fixed, and an electric motor will replace the present steam engine for driving the machinery in the workshop, the motor being so arranged that it can be driven as a dynamo from the old steam plant, and so keep the accumulators charged should the water supply fail, due to drought or other causes. The cattle mounts, points, and turn table will be lit by means of arc lamps on iron poles.

Liverpool.—The Liverpool Electric Power and Lighting Committee have recommended the purchase of three high pressure steam alternators for the generating station at Lister Drive, and six sets of transforming apparatus for sub-stations, at a cost of £22,059; also of three steam dynamos, for the Pumpfields station, at a cost of £6,921 per set.

London—Southwark.—A serious explosion occurred in one of the mains in Borough High Street last week, owing to a defective electric circuit.

Lytham.—The T.C. has decided to advertise for tenders for the installation of an electric lighting plant at Lytham.

Maidstone.—The R.D.C. has resolved that a coal shed be erected, a permanent way be laid, and travelling crane obtained at an estimated cost of £1,145, provided the sanction of the L.G.B. be obtained to a loan.

Middlesbrough.—It is stated in the local press that the Cleveland and Durham Electric Power Company are making arrangements for putting down a large electric power station at Middlesbrough, to supply works at shipyards in the neighbourhood. There are also other stations in the Durham district in contemplation, and Mr. H. Graham Harris, of Messrs. Bramwell & Harris, London, has been appointed consulting engineer to the company. Contracts are now being entered into by consumers for the supply of electrical energy in different parts of the district.

The Normanby Ironworks Company, Limited, have just introduced at their Cargo Fleet Ironworks, near Middlesbrough, an extensive electrical plant for the operation of the pig-iron bed crane, the pig-breaker, and the blast furnace hoist, as well as for the lighting of the shops and offices. The hoist motor is arranged to develop from 120 to 150 B.H.P., when running at 450 revolutions per minute. An automatic brake is fitted to the motor, so as to bring the hoist to a standstill in the event of the current being cut off, either intentionally or otherwise. The liquid switch is fixed at the bottom of the hoist, and is fitted with automatic gear to throw the switch out of action, when the cages reach a certain level, without their being stopped by the attendant.

Newport.—Negotiations are in progress between the Corporation and Messrs. John Lysaght, Limited, Newport, for the supply to the latter of electrical power equivalent to 200 H.P.

Portsmouth.—The new naval barracks on the point of completion, which have been built to accommodate 6,000 men, are to be lighted throughout with electricity; 3,000 lights will be employed. The power will be derived from the Corporation sources. The E.L. Committee will have to lay down an additional feeder, transformers and switchboard, at an estimated cost of £1,179, which will form part of the loan already sanctioned by the L.G.B.

Rayleigh.—The Parish Council has considered a scheme proposed by Mr. F. Nalder for supplying electric light in Rayleigh, and has obtained the consent of the R.D.C. of Rochford to Mr. Nalder's application to the B. of T. for powers.

Salford.—The T.C. has rescinded its previous resolution to appoint a committee of inquiry into the electricity undertaking, and has resolved instead to appoint a barrister or solicitor to hold the inquiry.

Sheffield.—The E.L. Committee has decided that Mr. Robert Hammond be requested to examine the site of the proposed new power station, and report on the scheme and plans prepared by Mr. Fedden, at a fee of £262 10s.

South Staffordshire Mines.—Mr. E. Howl (the Mines Drainage Commissioners' manager) recently reported in favour of Leabrook as one of the most suitable places in the district for pumping by electricity, but states that the price quoted by the Midland Corporation for energy is still too high to make this commercially practicable. The matter came before the Commissioners last week, when the chairman stated that the Corporation asked for 1½d. per unit for surface pumping, and 1d. per unit in the mine. The price quoted would work out very expensively, and if insisted upon, it would pay the Commissioners better to put down gas engines for the generation of their own electricity, getting their supplies of gas from the local gas companies until such time as Mond gas is available.

Spain.—Plant is about to be put down to utilise the water power of the River Duero at Pesqueruela (province of Leon) in the generation of electrical energy, the necessary concession having just been granted.

Stourbridge.—The Electric Powers Committee of the Urban District Council has opened negotiations with the British Electric Traction Company with a view to obtaining from them a proposal for taking over the Council's electric lighting Order.

Swansea.—The E.L. Committee has received tenders for the erection of two 600-KW. direct current steam dynamos, together with condensing plant for each engine, and all steam pipes, valves, connections, &c.; 27 firms tendered, 21 being British. It was decided to recommend the acceptance of the tender of Messrs. McLaren for the boilers, &c. No decision was come to with respect to the dynamos pending the receipt of further information.

A letter from the South Wales Electric Power Distribution Company, asking permission to run mains into the area of the Corporation, from which they were excluded by the Act of 1900, was referred to the electrical engineer for a report.

Weybridge.—The Electric Supply Company offer to provide, light and maintain 100 25-C.P. lamps at £2 15s. each per annum; and 77 32-C.P. at £3 5s., the total yearly cost being £525, as compared with £508 now paid for gas lighting. The gas company, however, offer to reduce their charge of £2 17s. 6d. per lamp to £2 14s.

Whitby.—The U.D.C. has resolved that the West Pier be fitted with nine electric glow lamps of from 200 to 300 C.P. each, at a cost of £160 to £200.

Whitehead (Co. Antrim).—A company is being formed to promote the electric lighting of the town—a growing watering place on Belfast Lough.

Worthing.—The T.C. has decided to apply for the sanction of the L.G.B. to a loan of £8,459 for extensions of the electricity installation. The applications for supply now equal 8,000 8-C.P. lamps, the total capacity of the present works. The total cost of the works now in hand will be about £37,000. The additional expenditure will nearly double the effective output of the works.

York.—The E.L. Committee of the Corporation has recommended the acceptance of the tender of Messrs. Dick, Kerr and Co. for extensions of the machinery at the works on Foss Islands, at a cost of £16,904. The Committee proposes to erect the extensions to the station on the north-west side of the existing works. This will necessitate the pulling down and re-arrangement of the present building and the erection of a new chimney.

It is proposed to make a charge of 3d. per unit for energy supplied to consumers in connection with illuminations during the forthcoming Coronation festivities. Mr. C. O. Milton, who was appointed assistant electrical engineer at the last meeting of the Council, having informed the Committee that he had obtained a better appointment, it was proposed to appoint Mr. E. E. Smeeton, of Leeds, as assistant electrical engineer.

ELECTRIC TRACTION NOTES.

Brighton.—The car shed is to be extended at a cost of £2,284. The Tramways Committee recommended that "an eminent tramways and electrical engineer" be appointed to report as to the most economical way of generating electricity for tramways purposes, and at what cost per unit such electricity could be generated.

It is reported that Mr. F. B. Behr has been commissioned by an influential syndicate to prepare plans for a new electric railway (mono-rail) from London to Brighton.

Bulawayo.—The Town Council lately met to discuss the proposed construction of a tramway system, and it was eventually agreed, among other things, that the motive power be electricity, the company to have the right to supply energy to the public.

Cape Town.—The Cape Electric Tramways, Limited, has given notice of their intention to introduce a Bill into the local House of Assembly to empower them to erect an electrical power station, to effect mechanical and electrical junctions with the tramway lines of the Metropolitan Tramway Company, Limited, &c.

Crewe.—The inhabitants have expressed themselves, by a majority, as opposed to the proposal of the Corporation to construct light railways for the borough. The voting was 1,076 for the scheme and 1,418 against.

Darlington.—The T.C. on 3rd inst. passed the recommendations of the Tramways Committee, which were printed in our last issue.

Dewsbury and District.—Stores and materials have been accumulated in all parts of the district, and it is expected that Messrs. Dick, Kerr & Co., the contractors, will commence work in connection with the construction of the tramways for the B.E.T. Company in a few days. Considerable improvements have been effected in the present service of steam trams between Dewsbury and Gomersal since they were taken over by the B.E.T. Company. The fares have been reduced, the service has been accelerated, the ticket system has been adopted in place of the cash box, and the men have just been put into smart uniforms. It is intended eventually to run the cars along this route by electricity. Reference has previously been made to the fact that negotiations were proceeding between the Traction Company and the several local authorities through whose districts the trams pass for the purchase of their sections. All the authorities had given notice to the old company of their intention to purchase, but the Traction Company secured control of the undertaking by purchasing the bulk of the shares. The authorities have now to deal with the Traction Company. An agreement has been arrived at with the Dewsbury Corporation, who have agreed to purchase their section—only about half a mile—for £2,750, and lease the lines to the company for 28 years at an annual rental sufficient to pay the interest and sinking fund on this sum. At the end of that time the trams will become the property of the Corporation, and will not have cost the town a penny.

Gateshead.—At the last meeting of the T.C. the Parliamentary Committee reported that they had received a letter in support of the Gateshead and District Tramway Company's application for the consent of the Council to the abolition of the halfpenny fares upon some of the tramway routes. Mr. Humble, the secretary of the company, wrote that, leaving out of account altogether the Bensham section, which was not fully working, the total receipts for the complete six months' running ending February 28th amounted to £13,000, and the car-mileage run during the same period was 351,000. The average receipts during that time had been, therefore, only 8·88d. per car-mile. The Committee now proposed that a reply be sent to the company declining to agree to the abolition of the halfpenny fares, and to this course the Council agreed.

Germany.—The work of converting the railway between Stuttgart, Degerloch and Vaitingen into an electric line is approaching completion.

Glasgow.—At the meeting of the Corporation on 3rd inst., it was agreed to reduce the fares considerably all round. The acting convener, Mr. Hugh Alexander, in place of Bailie Paton, the convener, who is still far from well, moved the approval of the minutes as follows:—Four ½d. stages for 1d., six for 1½d., eight for 2d., and so on. Instead of 1⅔ miles for 1d., they would be carried 2½ miles. No alteration in ½d. proposed. A good deal of opposition was shown in the debate, but the minutes were approved by 44 to 20 votes. Mr. Alexander incidentally mentioned that though the costs were about £10,000 per week, he submitted they were allowing for a substantial surplus. The cars were costing, no doubt, a considerable sum for upkeep; he was informed depreciation would be about £50 per car per annum. The rails were also wearing much faster than was anticipated. Under these circumstances the step might, perhaps, be termed bold, but he was convinced it was perfectly safe, and it was helping to solve the housing problem. While the present system was not the best, he pointed out that, when complete, the whole undertaking would involve a capital account of 2½ millions, and they would have a system on its trial—and a better system would be devised some day, he believed. Councillor Bruce Murray said that at no very distant date the whole system would require to be thrown on the scrap heap!

It is estimated that at the close of the present financial year of the Corporation Tramways, on May 31st, 1902, 165 million people will have been carried against 132½ million in the previous year; 36 per cent. of the passengers were ½d. payers, and contributed 20 per cent. of the total revenue; 56 per cent. of the passengers were 1d. payers, and contributed 63 per cent. of the total revenue; 8 per cent. of the passengers paid over 1d., and made up the remainder of the revenue, viz., 17 per cent. It is calculated that an increase of £120,000 will be the result of this year's working compared with last year.

The Glasgow Corporation have intimated to the Renfrew County Council that they are about to proceed with the tramway extension to Paisley, and meantime to complete as far as Crookston. The County Council have granted permission to proceed.

Halifax.—On Saturday last, the Halifax West Riding magistrates fined the Bradford Corporation for street obstruction, because they placed at their tramway terminus at Queensbury an old car to be used as an office during the holidays.

Leeds.—Bradford and Leeds are now united by a tramway, and last week the journey between the two cities was accomplished by electric cars in 1 hour 11 min. The Corporations work the line. The fare is 6d., payable in six stages.

Leith.—The British Westinghouse Electric and Manufacturing Company have asked the T.C. upon what conditions the Corporation would grant a lease of the tram lines to a company, which would furnish the capital for converting the system into an electrical one, carry through the work of conversion, and operate the lines. The T.C. resolved to take no action on the communication.

Liverpool.—The first annual report of the working of the Liverpool electric tramways has been issued by Mr. C. R. Bellamy, general manager. The report covers the year which ended on December 31st last, the first year of the full working of the electric system. It is explained in the report that when the undertaking of the Liverpool United Tramways and Omnibus Company was taken over by the Corporation on August 31st, 1897, the total length of single track in Liverpool was about 68 miles. There were also 6 miles in Bootle, and ⅔ of a mile in Litherland. The vehicles in use numbered 267. The total annual mileage was 6,013,182, and the number of passengers carried annually 38,409,014, and the receipts £290,743. Parliamentary powers were obtained for reconstruction and extension, involving about 114 miles of tramways. The work of reconstruction began on January, 1899, and was completed by October, 1900. The whole of the car repair work is now done at the Lambeth Road works. During the year 2,955 cars were taken in for repairs, showing that each car ran on an average 3,642 miles before needing repairs. The overhead equipment department has been completely re-organised. The improvement is shown by the fact that in December last the emergency calls were 122, against 206 in June. The total electrical energy used for traction, and for lighting the cars during the year was 13,679,222 units. The cars on December 31st numbered 432. During the year a new form of lifeguard, plough-shaped, to "shear" a body clear of the car wheels, had been adopted. A hundred of the cars were fitted with this lifeguard, and the Committee were so satisfied with its working that another hundred of the guards have been ordered. The total population of Liverpool is 684,947. The length of the average stage throughout the city is 2¼ miles. The average passenger fare for the year amounted to 1·111d. In 1897 the average fare was 1·82d. The percentage of increase under the respective heads in 1901 compared with 1897, was:—Passengers, 163·2; mileage, 82·4; receipts, 61·1. During the year 355 vehicles were regularly in service. They made 1,341,269 journeys, carried 100,076,789 persons, and ran 10,771,461 miles. The average receipts per mile were 10·32d., per journey 6s. 11d., and average receipts per car were £1,304 13s. 9d. The total receipts amounted to £463,163 17s. 3½d. The number of cars reaching and leaving the Pierhead—the riverside terminus—in the busy season is 5,362 per day. 10,104 articles were found on tramcars during the year, and of these 5,965 remained unclaimed. The staff numbers 2,293 employés. Up to date about 800 men have been trained as drivers, been examined and certified, and 40 principal inspectors have been trained at the Lambeth Road works in matters affecting the mechanical construction, working and repairing of cars. The gross profits for the year amounted to £147,057, and the net credit balance to £52,822. Powers are to be sought to allow the Corporation, after setting aside annually for renewal, reserve, &c., a sum of £30,000, to carry any sum exceeding the £30,000 to the credit of the general rate provided that in no year up to January, 1912, more than one-third of the total surplus be so carried to the credit of the general rate.

Lourenço Marques.—The scheme for furnishing Lourenço Marques with an electric tramway, with which Mr. J. C. A. Henderson's name is associated as concessionnaire, has so far progressed, says the *British and South African Export Gazette*, that a company, to be called the Delagoa Bay Electric Tramways Company, has been floated to carry out the undertaking, and Mr. Thomas Scott, chief engineer and general manager of the South African department of Messrs. Macartney, McElroy & Co., Limited, London, is draughting the plans and estimates on the spot. The network of the proposed installation will start at the railway station, run along Rua Dona Luiz as far as Rua Dom Manoel, where, splitting into two branches, one will strike westward to the Barracks and the other go to Reuben Point. Another line will start from the passenger jetty and make junction just beyond the Square with the first-named line, over which it will run as far as the Central Avenue, where it will make a diversion for the cemetery. So soon as the plans are completed and approved, the machinery and plant will be ordered, but necessarily some months must elapse before tangible progress is reported.

(*Continued on page* 611.)

Electric Lighting and Illumination.

By the courtesy of the engineers of the majority of the electric lighting works in the United Kingdom, we are enabled to indicate on other pages of this issue something of the arrangements which are being made, to ensure for the matter of electrical illuminations that amount of attention and encouragement which it is only right should be accorded, by those in whose hands, it lies to popularise yet more the use of electricity.

Since the last great National celebrations electricity has been making great strides, and since the Royal festivities of 1887 and 1897, and the wedding rejoicings for the Prince and Princess of Wales in 1893, supply mains have been laid in hundreds of miles of streets in the London district and the more important provincial towns, so that there is now available a full, and in most cases inexpensive, provision of electrical energy. Manufacturers and electrical contractors have organised their illumination departments well in advance, in readiness to meet the demand of the public for decorative electrical devices, and for the general illumination of buildings.

One unfortunate thing in connection with the whole matter, is the disposition which generally exists on the part of the public to put off whatever steps they may take until the last moment, with the result that their wants cannot be met. We have no doubt that electrical firms, both trading and wiring, will see to it, that probable customers are kept alive to the truth that delay may lead to ultimate disappointment. It seems to us that it will not be the fault of the electrical trade if there is not a grand showing of electrical illumination, in London at any rate, in the month of June.

We give below some details of the several systems of illumination now on the market, with illustrations of specimen devices. A number of new fittings and accessories for electric lighting have recently been introduced, and we give a few particulars of these also on the following pages.

G.E.C. Coronation Devices.

The General Electric Company (1900), Limited, of Queen Victoria Street, E.C., has, as might be expected, laid itself out especially to meet a large demand for illumination devices and decorations during the Coronation festivities. A variety of designs are shown in the special list recently issued by them.

These designs are original, and they include transparent portraits of the King and Queen, lighted by lamps contained inside metal boxes, with blue letters on ground glass for the inscription similarly lighted, the medallions being surrounded by illuminated wreaths. The design is also embellished with a luminous orb and crimson draperies. The G.E.C. foliage and luminous flower sprays will, no doubt, be very effective. In fig. 1 we show sprays of artificial leaves and flowers with hanging lanterns in the national colours. These sprays are wired on to adjustable iron wire to fit various-sized

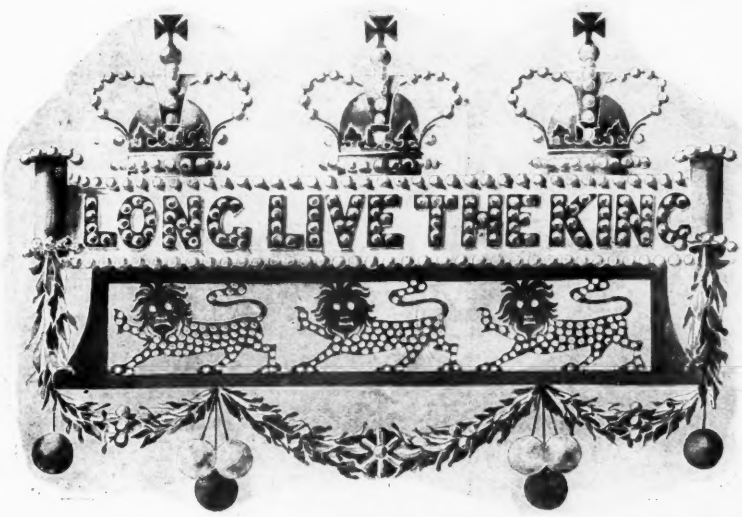


Fig. 3.

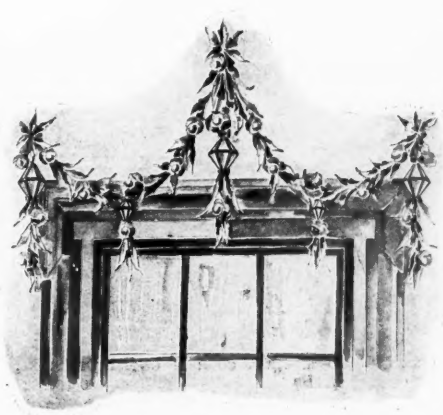


Fig. 1.

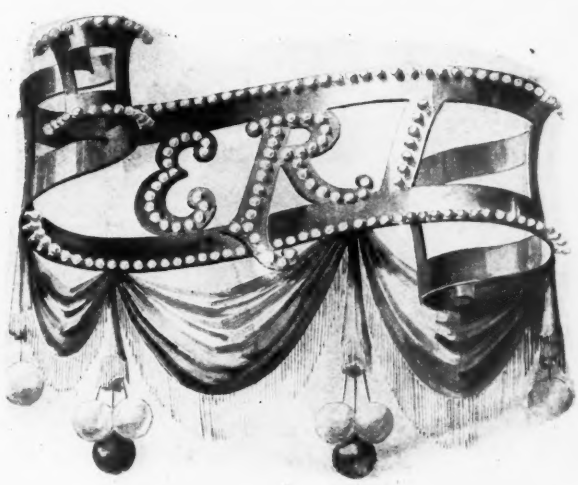


Fig. 2.

G

of the Corporation Tramways, on May 31st, 1902, 165 million

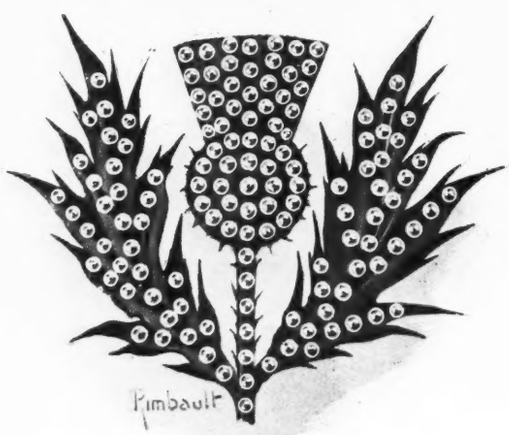
(*Continued on page* 611.)

window heads. The G.E.C. designs in wire have the lampholders carried by loops in the framework, and they are supplied wired complete, ready for fixing. Fig. 2 represents an artistic piece of gilt-metal ribbon work, with the Imperial monogram worked in between the ribbons. It is draped with crimson draperies, with a fringe which is further relieved by groups of coloured balloons. Fig. 3 shows a piece of gilt-metal scrollwork, with the inscription in incandescent lamps. The scroll, as may be seen, is outlined with lamps, and is surmounted by three gilt-metal illuminated crowns. Pendant from the scroll are three lions, made of painted and perforated metal. The eyes of the lions are set with lamps, and the bodies are illuminated by lamps placed behind. Festoons of artificial foliage and flowers are hung below, and relieved with groups of coloured balloons.

The General Electric Company has many other exceedingly attractive designs of devices of a similar character, but the three which we have selected will convey a general idea of the class of work they have taken in hand. Of course, the company do not limit the purchaser to their own designs. The services of their artists are at the disposal of anyone who is anxious for them to draw up schemes for successfully illuminating and decorating buildings, either as simple or as elaborate as one pleases.

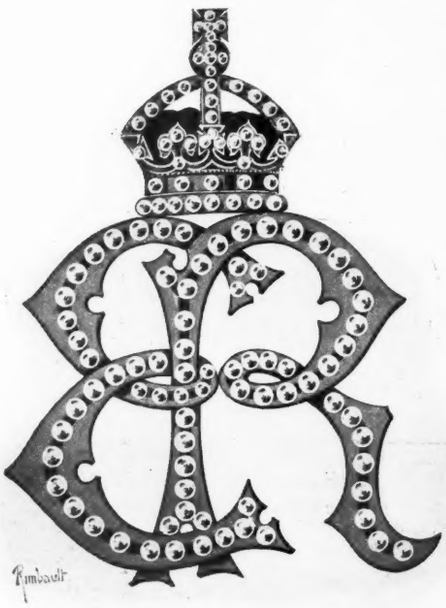
The E.L.B. System.

As our readers are fully aware, the Electric Lighting Boards Company have been doing a very large amount of excellent electrical



E.L.B. Devices.

illumination work in different important cities, both on the Continent and in the British Empire, during the past year or so. The energetic and up-to-date methods which have been adopted by the company wherever an opportunity has arisen for introducing its simple, artistic, and effective system of decoration and illumination, will, of course, be displayed, but to a far greater extent in the London and provincial preparations in honour of the King and



E.L.B. Monogram.

Queen. We are informed that the company has booked, among other business, the illumination of two important streets on the E.L.B. system, and the illumination of vessels in various ports. Many a building will be decorated with mottoes and sentences built up on the company's boards with electric glow lamps, or with fancy barricading, in some such manner as appears in the accompanying illustrations. Readers of the Electrical Review already know

One of the E.L.B. Victor Hugo Decorations.

pretty well what the E.L.B. system is. Its purpose is to provide a board or surface on which electric lights can be applied at any point, and moved from point to point with ease, and without special wiring or the installation of special appliances. The shape of the board is immaterial, and its dimensions can be varied to such an extent, that one of the developments already arrived at is a narrow electric lighting strip of any length, which can also be made flexible if desired.

Incandescent lamps, standard lamps, wall plugs, ceiling plugs, &c., can be supported by these boards and strips, and at the same time make perfect contact on any part of a prepared surface, doing away entirely with lampholders, sockets, tapping and fixing, &c., and thereby reducing the cost of material and amount of labour to a minimum.

Contact is made by preparing the surfaces in such a manner, that special spikes attached to the bases of an incandescent lamp, plug, &c., if pressed in and home at any desired spot, will obtain support in the permeable substance of the surface, and instantaneously make a thorough electrical contact with the conducting material underneath. To facilitate the spikes in the accessories penetrating the substance, the makers have affixed to their lamp caps and plugs a specially milled shoulder, which juts out from the base of the cap of the lamp, and enables any person easily to pierce the surface. The boards, strips, &c., are thoroughly fire and damp proof. It is quite simple to make the parts entirely waterproof for outside purposes.

It should be stated that on the occasion of the recent Victor Hugo fêtes in France, the City Council of Paris, through the E.L.B. Company's Paris agents, had the whole of the great illuminations carried out with the company's material, the decorative scheme involving the application of no less than 25,000 electric lights, mainly applied to the Place Victor Hugo, the Place des Vosges, and the Place de l'Hotel de Ville. On p. 596 we show one of the features of the decorations as then carried out on the system. Communications should be addressed to the Electric Lighting Boards (British Manufacturing) Company, Limited, 7, Pall Mall, S.W.

Parian Marble Busts.

A novel and effective form of illumination for the Coronation will be found in the patent translucent Parian marble busts of members of the Royal Family. These busts are lighted from the inside by electricity, and lend themselves to a variety of forms for decorative

purposes. We give illustrations showing a couple of specimens, but a display of them in different sizes and lighted up can be seen at the offices of Mr. J. J. Smith, 47, Holborn Viaduct, to whom, in conjunction with the Electrical Company, Limited, of Shaftesbury Avenue, W.C., the sole agency for their supply has been given. We understand that there is a very large demand for these goods for placing inside windows or outside premises in June for illumination purposes, and for table decoration, &c. The busts are placed on art metal pedestals and are stated to be suitable for all weathers.

The "Cremorne" Illumination System.

Messrs. Falk, Stadelmann & Co., Limited, of Veritas Lamp Works, 83 to 87, Farringdon Road, E.C., are laying themselves out to meet a big demand for the Cremorne system of illumination lamps and wiring. The firm has been in communication with a large number of borough electrical engineers and electricity supply companies in different parts of the country, and extracts from the replies received from some of them are printed in a new circular which they have issued. For the purpose of outlining buildings, windows, &c., common wood battens about 2 × ¾ in. are used, to which the patent insulators are loosely screwed about 18 in. apart. The wire, which is preferably, for reasons of rigidity, stout galvanised iron or copper wire, is laid through the grooves in the insulators, the whole being then firmly tightened up. The patent insulators are made so that they can be used either way up, to allow of the water dripping off them, also when fixed in a suspended position. After the battens are thus fitted, they are affixed to the building to be illuminated, and the wires connected to the supply. The lamps are then, by means of the patent spring sockets, simply clipped on to the wires as closely together as desired. For horizontal lines lamps with straight springs are used, whereas for vertical lines those with bent springs are employed to better advantage.

The special advantages claimed for the system are low cost and rapidity of fitting up, material employed can be used again, the number of lights can be increased, reduced, or entirely rearranged, lamp holders being dispensed with, and the system is weather-proof. It is interesting to note that at the Paris Exhibition the year before last 80,000 of these lamps were in constant and successful use, and the effect at night with the 10,000 lamps around the Water Palace was very beautiful. A list showing illustrations of many designs of shields, crowns, letters, and other illuminated devices can be

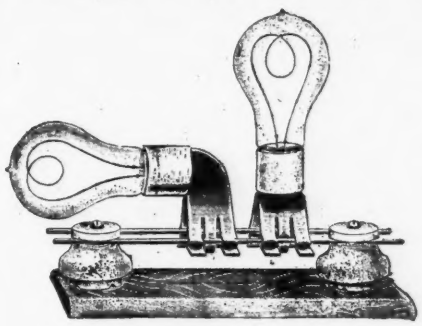


Fig. 1.—Cremorne System.

obtained on application to the firm. The system may be readily understood from a glance at the accompanying drawing (fig. 1), and fig. 2 is a photographic reproduction showing buildings

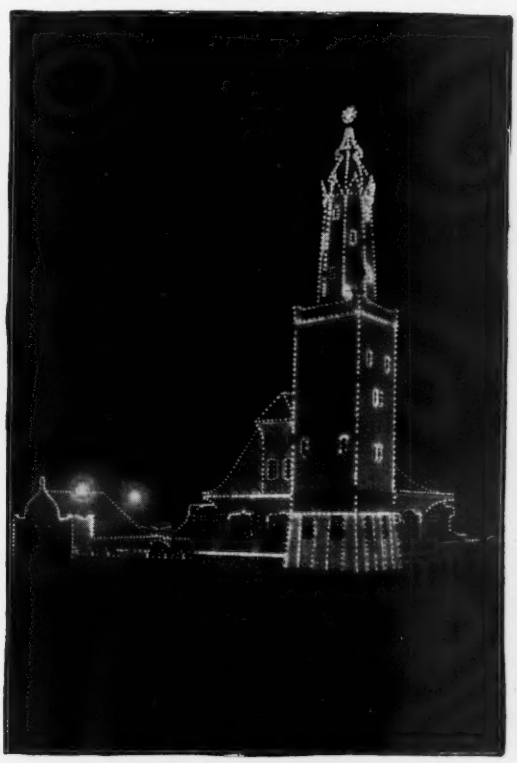


Fig. 2.—Cremorne System.

wired in this way. Those who are specially interested in the matter should pay a visit to Farringdon Road, where they will see the entire front of Messrs. F. S. & Co.'s large premises already fitted up on the Cremorne system.

The Flame Arc Lamp.

This interesting novelty, which is being introduced by the Union Electric Company, Limited, of 151, Queen Victoria Street, E.C., was noticed in brief a few weeks ago in our columns; we give below a description of the arc, and of the feeding mechanism.

The special features of the arc are its extraordinary length, and its position in what may be regarded as a miniature reverberatory furnace, by which the temperature is maintained at a high value, and the carbon vapour prevented from cooling. At the same time the "furnace" forms a reflector, which throws down a large proportion of light which would otherwise be expended above the horizontal plane through the arc, and therefore would, in most cases, be wasted. A curious phenomenon in this lamp is the fact that a crater is formed in the *negative* as well as in the positive carbon, so that when removed from the lamp, the two carbons can only be distinguished by experts; in consequence of this, practically the whole of the globe surrounding the arc is brightly illu-

nent and in the British Empire, during the past year or so. The energetic and up-to-date methods which have been adopted by the company wherever an opportunity has arisen for introducing its

if desired.

minated, and as the carbons are provided with cores containing certain salts, the light is of a pleasant yellowish-white quality.

Owing to the unusual length of the arc, special mechanism has been devised, giving a very long travel in striking the arc—about ½ in.; the arc is normally about ⅝ in. in length, and is of a curious shape, somewhat resembling a coffin, or perhaps more like the bulb of a glow lamp.

The lamp is differentially wound, and the feed depends upon the position of an armature moving in a curved path between the horns of the series-wound electro-magnet, which is placed horizontally at the top of the lamp, and the horns of the shunt magnet, which is placed vertically at the side, as shown in the accompanying diagram and elevation, figs. 1 and 2.

As the current in the shunt coils increases, owing to the increased resistance of the arc, while, at the same time, the current in the series coils diminishes, the armature moves in a downward direction and carries over the locking mechanism, which releases the four-armed fly-wheel from the detent, permitting the carbons to feed together a pre-determined distance, viz., the distance that is controlled by the movement of one tooth in the fly-wheel.

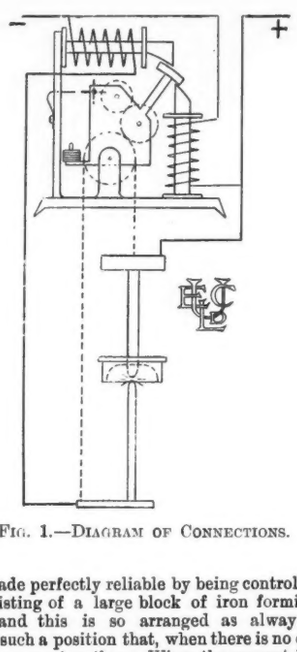


Fig. 1.—Diagram of Connections.

The feed is made perfectly reliable by being controlled by gravity, the weight consisting of a large block of iron forming the upper carbon holder, and this is so arranged as always to pull the mechanism into such a position that, when there is no current on the lamp, the carbons come together. When the current is switched on the series coil draws the armature upwards, and opens the arc about ⅛ to ⅝ in.

The rough adjustment of the lamp is provided by the ampere-turns in the coils, and the fine adjustment by placing a small washer upon an arm shown in the front of the lamp. In this way an arc of any desired resistance can be obtained.

The mechanism is prevented from working too rapidly by an air dash-pot, shown at the back. The cables enter through porcelain bushes in an upward direction, and are fixed into side screw terminals, the positive terminal being connected by means of a flexible wire with the upper carbon holder. This flexible wire takes the form of a spiral, and is kept in position by the upper rod in front of the upper carbon.

correct diameters, that the arc remains always in the same position, relative to the small fire-clay cap or reflector.

The latter, which is an important feature of the lamp, is fixed to a cross bar, and has through it a hole but slightly larger in diameter than the upper carbon, the object of this being to enable a smaller

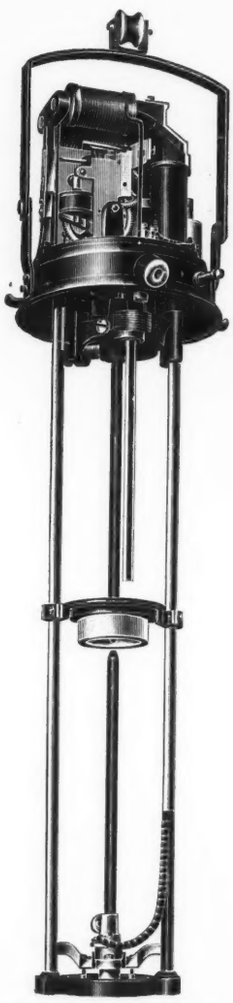


Fig. 2.—Flame Arc Lamp.

Fig. 4.—Pillar Arc Lamp.

carbon to be burnt. A secondary object is to obtain improved light-giving power, by throwing the rays in a downward and horizontal direction, this effect being greatly assisted by the brilliant white powder formed in the burning of the special carbons.

This lamp, like all others of the same manufacture, is constructed so that the lamp rods and base plate are securely insulated from

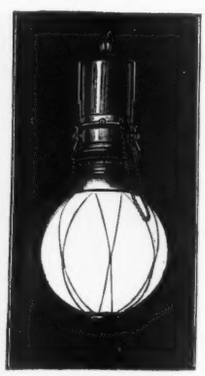


Fig. 3.

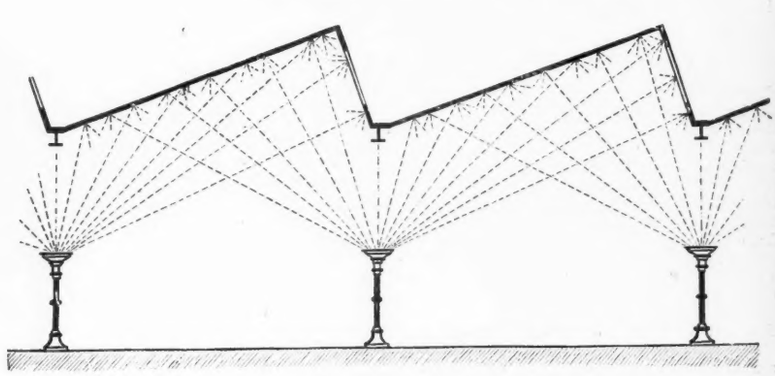


Fig. 5.—Factory Lighted with Pillar Arc Lamps.

The connection with the lower carbon is made through a wire in the rod, and then by insulated flexible, which is covered with glass beads.

The upper and lower carbon holders are connected together by means of a chain which ensures, provided the carbons have the

the circuit by means of mica, and the lamp is additionally insulated by means of a porcelain ring by which it is suspended.

The globe and its sleeve pass up over the rods of the lamp, and are securely locked into position by means of a link which fixes all the external parts of the lamp rigidly together. The wheel

The special advantages claimed for the system are low cost and rapidity of fitting up, material employed can be used again, the numtically the whole of the globe surrounding the arc is brightly illu-

mechanism is most carefully machine-cut, and proportionable both in strength and wearing power, so that the lamp not only works well, but is very durable.

The trimming of the lamp is exceedingly simple, all that is required being to clean the guide rods from the products of combustion and place new carbons of the correct length in place; the lower carbon holder being provided with a free motion enabling the carbons to be perfectly aligned. The globe, when lowered, is suspended by chains of hard copper links, which have been found more durable than brass. Fig. 3 shows the complete lamp, as it appears when burning.

We gave the results of some tests upon this lamp compared with an open arc lamp in our issue of March 28th; the following data, which embody the foregoing, also show the comparison with an arc lamp of the enclosed type:—

Direct current; C.P. mean (lower) hemispherical.

Flame Lamp.		Open Arc Lamp.		Enclosed Arc Lamp.	
Watts.	c.p.	Watts.	c.p.	Watts.	c.p.
300	1,320	287	610	300	330
307	1,700	300	895	400	520
515	2,125	503	1,365	310	710

Inner cylinder *only*.

Ratio of Flame to Enclosed Arc, c.p.

Watts.	Flame.	Enclosed.
300—300	4	1
387—400	3·28	1
515—510	3	1

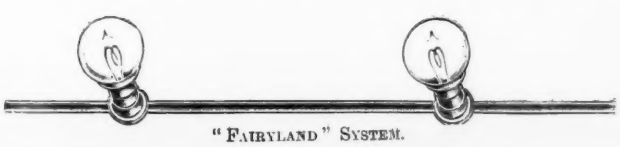
We understand that the lamp has excited much interest and elicited many inquiries.

The "Pillar" arc lamp, which we illustrate, is also one of the Union Electric Company's specialities. This, it will be seen, is supported from below, and the arc is inverted so as to produce, in combination with a whitened ceiling, the well known advantages of perfect diffusion and absence both of shadow and of "dazzlement." The arc is entirely concealed from the eye, and the absence of devices for the suspension of the lamp is an important advantage; trimming is easy, and as the lamp can be fixed much lower than would be possible were it suspended, the light can be thrown over a much wider area of ceiling. Further, the whole of the reflector can be closed in with a glass cover, so that the arc can be used with perfect safety in spinning and weaving mills or other places where highly-combustible materials are dealt with. The wiring is done from below, through the pillar. One of our figures shows the arrangement of the lamps in a factory with a "saw-tooth" roof.

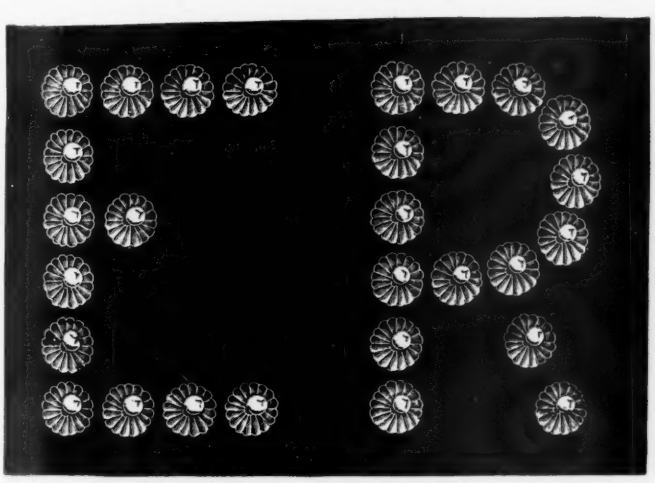
"Fairyland" Illumination.

The "Fairyland" system of electrical illumination (patented and registered) consists of either two separate cables, or a twin cable, to which are attached, at any distance apart from one another, holders specially designed for the purpose. This holder is generally fitted to take the ordinary B.C. lamps, that being the standard for this country. Where decorative effect is desired, japanned reflectors in various art colours are employed, and then by using a wholly or partly coloured lamp, according to the colour of the reflector, a beautiful effect is stated to be obtained. The pretty colours employed in the reflectors are considered to render the system attractive by day. In fact, it is said that drapery or flag embellishments are unnecessary with it; and as there are no celluloid or artificial flowers, the system is practically fireproof. The holders are fixed on by the makers (the Imperial Lighting Company, 13, Gate Street, Holborn, W.C.), thus saving contractors' time, but arrangements can be made by which contractors can fix them on themselves if desirable. The lampholder plungers are direct connected to the cable, there being no "T" jointing or looping in. After the plungers are connected, the back of the holder is filled in with boiling bitumen, which thoroughly insulates and seals the connection. A soft rubber ring of special construction is inserted into the cylinder before the lamp is put in, so that when the lamp is inserted this ring is compressed, making a tight joint, something similar to a stopper in a mineral water bottle. The makers claim for the "Fairyland" system simplicity, beauty, and low cost; further, as ordinary B.C. lamps are used, they can, of course, be used afterwards on the ordinary lighting circuit, as a little methylated spirit will remove the stain from the lamps. The holders can be used for a variety of purposes, such as shop windows, ships, mines, or, in fact, anywhere, as it is the company's intention to make a plug to which a flexible cord can be attached for insertion in the holder, thus making an ordinary drop pendant. This arrangement will come in very handy, especially for shops where a long row of lights over the counters is the rule, because when the shades on these drop lights require cleaning, they can all be unplugged, taken away, cleaned, and then replaced. For illuminating small buildings the 8-in. reflectors are used, but for large buildings, bridges, ships, and streets, it is preferable to use the larger sizes (12 in. and 10 in.) and space them further apart. As there is very little dead weight, very long spans can be made.

The following firms have been appointed wholesale agents for this system, and consequently electrical contractors and all who are allied to the trade can obtain the material through them just as well as from the Imperial Lighting Company:—Messrs. Veritys, Limited, Messrs. Edison & Swan Electric Light Company, Messrs. J. Milne and Sons, Limited, Messrs. D. Hulett & Co., Limited.



"Fairyland" System.



"Fairyland" Devices.

Coronation Lampholders.

In view of the coming Coronation festivities, the Electric and Ordnance Accessories Co., Limited, of Stellite Works, Cheston Road, Aston, Birmingham, are making a speciality of an incandescent lampholder, for which are claimed the merits of cheapness, reliability and safety. Below is an illustration of this holder. It is fitted with spring contacts, the porcelain is of the "S" type, the terminal blocks are perfectly insulated, and the wiring is easily and securely done. The holder has three projecting feet, pierced to enable it to be attached to the board carrying the device to be lighted. It is a simple and effective article, and Coronation contractors who are interested in lighting fittings should communicate with the company. Amongst other articles, this firm is also putting on the market a new balance weight with a brass body of nea:

Electric and Ordnance Lampholder.

The upper and lower carbon holders are connected together by means of a chain which ensures, provided the carbons have the

The globe and its sleeve pass up over the rods of the lamp, and are securely locked into position by means of a link which fixes all the external parts of the lamp rigidly together. The wheel

design, which is very attractive in appearance. A china thumb switch in black and cream china, having double contacts and a quick-break, is also being manufactured by the Electric and Ordnance Accessories Company.

Thursfield's Electric Light Fittings.

Messrs. C. J. Thursfield & Co, of 10 to 13, Cecil Street, Birmingham, recently brought out a supplementary catalogue of

Fig. 1.

Fig. 2.

their early English designs, repoussé work and other fittings for electric lighting, an exhibition of which may be seen in London at their showrooms, Colonial Buildings, 59, Hatton Garden. The character of the work (hand-wrought repoussé) and design of fittings manufactured by them lend themselves more effectively to such finishes as antique brass, oxydised copper or silver. We give a few illustrations of selected designs. Fig. 1 represents a 4-ft. electrolier with hand-wrought scroll work which is made in antique brass or rich gilt colour, or of oxydised silver. A hand-wrought lantern (4 ft.) appears in fig. 2; this can be supplied with solid link chain, or with patent hollow link chain for enclosing flex. Among many very pleasing designs of pendants is the one shown in fig. 3. Judging from the general appearance of the fittings which are included

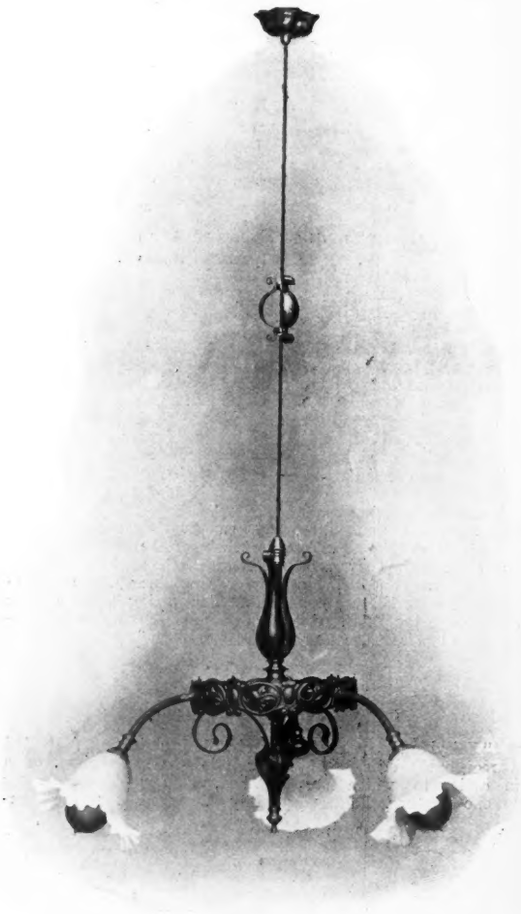
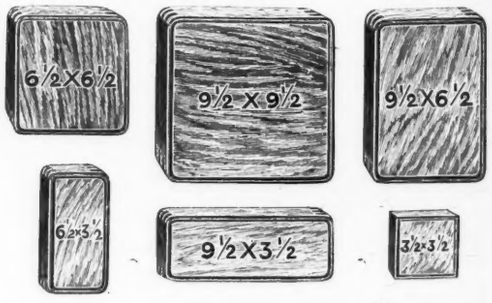


Fig. 3.

in this catalogue, Messrs. Thursfield are turning out some most excellent designs, and all being after the form of a coronet, they are very appropriate for the present season.

Wooden Switch Blocks.

The accompanying figures illustrate some of the various types and sizes of wood blocks kept in stock by Mr. W. Middlemiss, of



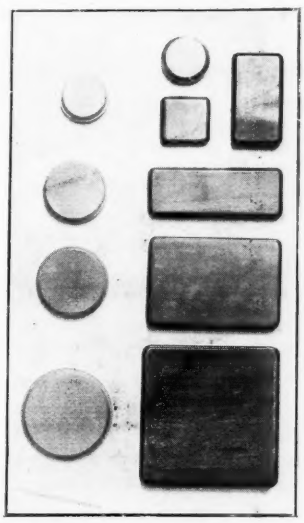
Nesfield Street, Bradford. These are made of teak, walnut, oak, mahogany and pitch pine, polished, and of white wood, enamelled or plain. They are recessed at the back, dovetailed at the corners when not made in one piece, moulded on the edges and with rounded corners. The "A" pattern (round) is $\frac{7}{8}$ in. thick, with a

lamps, that being the standard for this country. Where decorative effect is desired, japanned reflectors in various art colours are

on the market a new balance weight with a brass body of nea:

with the company. Amongst other articles, this firm is also putting

recess 2 in. diameter × ⅝ in. deep; the "B" pattern is 1¼ in. thick, recessed 2½ in. × ⅞ in.; the square blocks attain larger dimensions.



Middlemiss Wood Blocks.

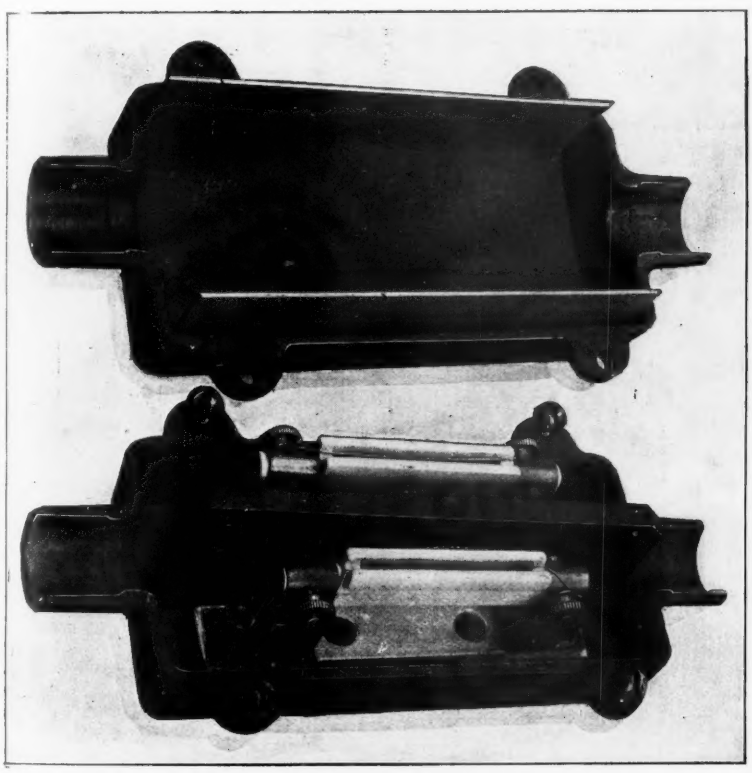
The blocks are of English manufacture, and, judging by samples received, are of first-rate workmanship and finish.

interior of the box, thus thoroughly insulating the live parts. The company's spring clip fuse bridges are used, and the fuse box presents a neat and workmanlike appearance. Full particulars can be obtained from the company.

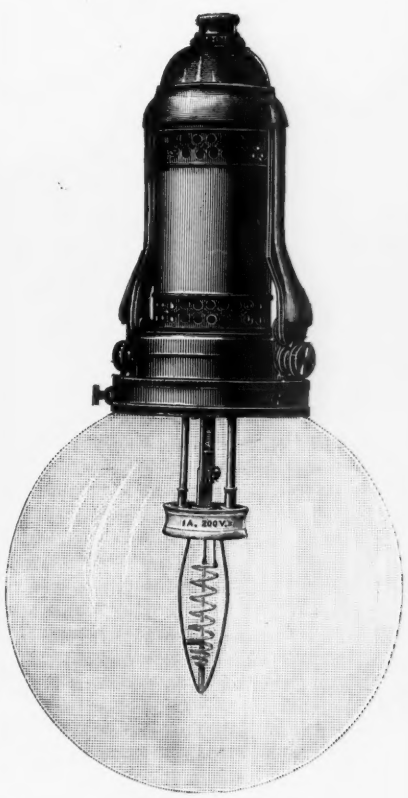
It is claimed by the company that for the electric wiring of temporary installations in connection with the Coronation illumination work, the "Simplex" conduit system is an effective and inexpensive method of protecting wires and cables from injury. The ease with which an installation can be erected on this system, and also the simplicity of its "de-erection," are factors in its favour for adoption in temporary lighting work. On account of its adaptability, and the large and assorted number of fittings and accessories which it comprises, the system lends itself to many attractive and ornamental arrangements of lights. Special illuminating devices can be easily worked out with a little consideration, and the labour required in erection is very low.

Nernst Lamps.

The Nernst lamp, which has created considerable attention ever since its invention became public, has at last been brought on the market by the Electrical Company, Limited, of Charing Cross Road, W.C. The price list containing a description of the lamp, will be found very interesting. The main advantage claimed for the Nernst lamps is an enormous saving in energy. Another advantage which will be greatly appreciated during the coming season, on account of the illuminations which will be required, is its great brilliancy. The Nernst lamps, therefore, are a most effective substitute for enclosed arc lamps. They combine efficiency and neatness with a brilliancy which is unequalled by almost any other artificial light. They do not require re-carboning, and produce a minimum of heat, while they are equally suitable for either indoor or outdoor use. The power consumption per candle-power is stated to be considerably less than one-half that of an ordinary incandescent lamp. We learn that the Electrical Company, Limited, have a very good stock of direct current lamps of all voltages between 100 and 250 volts, ranging from 59 to 168 c.p.



Simplex D.P. Fuse Box.



Nernst Lamp.

Simplex D.P. Fuse Box.

The split fuse box illustrated below, has just been brought out and patented by the Simplex Steel Conduit Company, Limited. It was primarily intended as a D.P. main fuse for small electric light installations, but it is also suitable for use on power circuits, arc lighting circuits, &c., and in any position on an installation where a separate fuse is necessary. At present the company are making three sizes, viz., to carry 5, 10 and 25 amperes. As the above figure shows, the fuses are mounted on separate porcelain bases, and enclosed in a substantial "Simplex" box of the "split" pattern. They are well separated by a stout ebonite fillet, running up the centre of the box, and inside the cover is fitted a sheet of insulating fibre, which, when the cover is screwed down, fits tightly round the

The illustration shows the complete lamp in half its natural size. It is so constructed that it can easily be connected to any bracket, or screwed to a pipe through which the wires run. Any further information can be supplied by the Electrical Company, Limited, of the above address.

Electrically Illuminated Letters.

We illustrate a couple of designs which have been specially got out for Coronation purposes by Messrs. O. Berend & Co., of Basinghall Avenue, E.C. Fig. 1 represents a shield which they make 3 ft. 6 in. high, but larger ones can be made, if required, to customers' specifications. Fig. 2 needs no explanation. The letters are made

their early English designs, repoussé work and other fittings for electric lighting, an exhibition of which may be seen in London at their showrooms, Colonial Buildings, 59, Hatton Garden. The

or plain. They are recessed at the back, dovetailed at the corners when not made in one piece, moulded on the edges and with rounded corners. The "A" pattern (round) is ⅝ in. thick, with a

entirely of metal, no wood being employed, and their great feature is to secure economy of current consumed, the lamps being so distributed that only the smallest possible number is required for effectively illuminating the entire letter, and the effect being increased by reflection. Each lamp is enclosed in a watertight fitting. Small bulb lamps must be used for the S.E.S. holders of the fittings. The lamps are wired in parallel, and for up to 250 volts. The wiring is

Fig. 1.—Berend Shield.

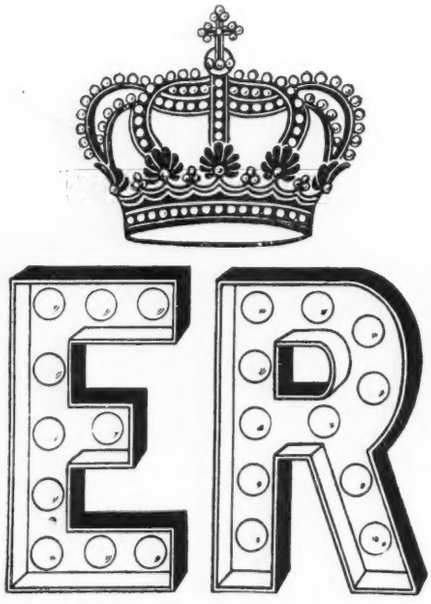
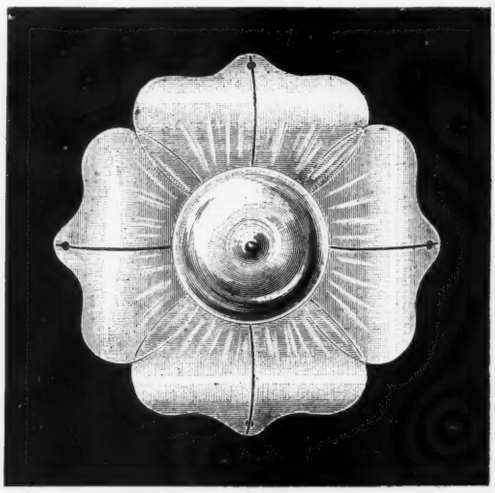


Fig. 2.—Berend Devices.

encased in the back of the letter, the two ends only projecting for connecting the letter to circuit. Each letter forms a self-contained, watertight, well insulated and substantial lantern. The inner surfaces of the letters are japanned white enamel, the outer surface in red enamel.

The Micaylorlite Reflector.

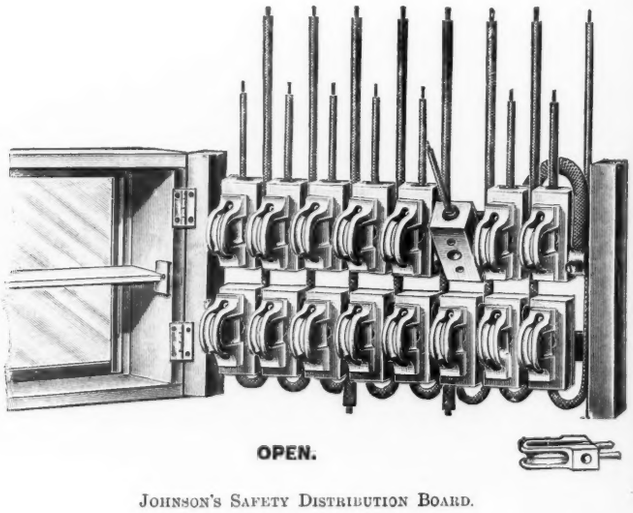
This ingenious device, which has previously been briefly noticed in our columns, consists of four mica wings attached to a brass collar, which can be slipped over the neck of any ordinary incandescent lamp, so that the wings form a four-sided reflector. The peculiarity of the reflector is that it is highly transparent, so that the filament is clearly visible from the sides through the mica; but when the lamp is viewed end-on, as in our illustration, the reflections from the inner sides of the mica vanes give, with the filament itself, the appearance of five filaments, and produce a brilliant effect. The effect is heightened by the use of coloured lamps, suitably disposed; and as the reflector is heat and weather proof, and requires no modification of the lamp or holder, it ought to be in considerable demand for illumination displays. It is made by Messrs. Taylor and Co., of 19, Hatton Garden, E.C.



Micaylorlite Reflector.

Johnson's Distribution Board.

The Johnson safety distribution H.V. board has been designed and manufactured to meet every requirement of the Institutions and fire office wiring rules. Its special features are that there are no metallic parts exposed, and each section being absolutely independent, any separate section may be wired while the board is "alive." It has visible fuses, but these are so arranged that it is impossible for them to blow in sympathy. Accidental "shorting" is claimed to be impossible. Wiring is easily done, and is quite impervious to moisture; there is no "bunching" of wires, and all bare ends of wires (including mains) are capped.



Johnson's Safety Distribution Board.

The following are the directions which have to be followed for wiring:—All the fuse carriers have to be removed; when the holding-down screws of the first and last porcelain blocks are taken out these two blocks will swing forward, and the binding screw at back of the porcelain is then removed. The distributing terminal being taken out, clear off to a shoulder the insulation of the feeder con-

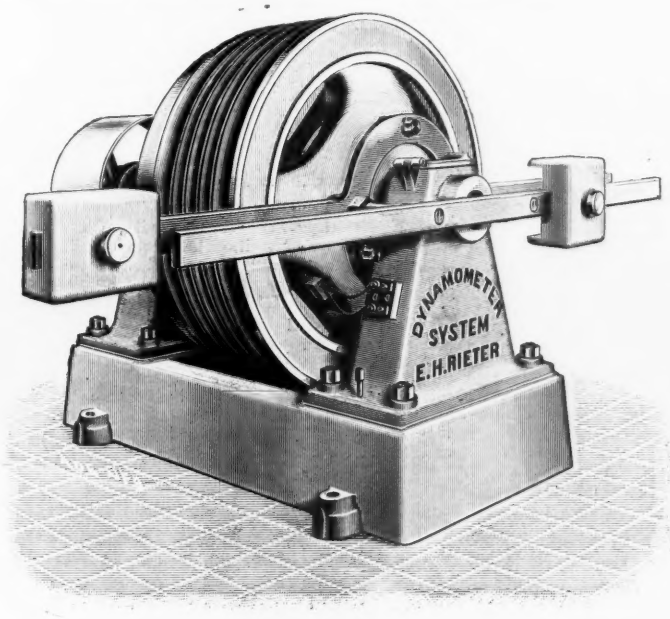
which, when the cover is screwed down, fits tightly round the

high, but larger ones can be made, if required, to customers' specifications. Fig. 2 needs no explanation. The letters are made

ductor sufficiently far back to allow the bare wire to go to the bottom of the hole in the terminal. The rubber strip has to be wrapped round neatly so that the junction between the terminal and the insulation is well covered, and the joint thus becomes waterproof. The slack should then be coiled up, and should be sufficient when payed out to allow the porcelain to come well forward. The terminal is then replaced in the porcelain recess, and so on, all sections of the board being wired in the same manner. The lower sections are wired in the same way, but the feeder wire should be led between the porcelain blocks of each section, under the small separating roller and over the battens. The mains are kept behind the battens and attached to bus-bar terminals at the end of each pole by the binding screw. It is claimed that a board so wired will give a good test even in a damp position after standing for 12 months. These boards are to be obtained from the Electrical Company, Limited, of London, the Electrical Trades Supply, Limited, of Birmingham, Messrs. Wharam & Borland, of Leeds, and other firms in provincial cities, also in Scotland and Ireland.

Rieter's Electrical Brake Dynamometer.

The dynamometer here illustrated is of the electrical absorption type. It consists of a magnetic system of two or more poles arranged so as to be capable of rotating through a small angle and mounted on ball bearings to reduce the frictional resistance to a minimum. This magnetic system may be excited by a dynamo or set or accumulators, the latter being preferable where very great accuracy is required. A cylinder of iron surrounds the poles. When this is driven by the power which is to be measured, eddy or Foucault currents are generated in the iron ring, and these currents exert a braking effort which tends to stop the rotation of the iron cylinder. By suitably varying the excitation, the dynamometer may be made to absorb the exact power required. The mechanical work is transformed first into electric energy and thence into heat, this heat being dissipated in the surrounding air by the rotating ring. The magnetic field is furnished with two levers carrying movable weights which serve to measure the power absorbed, after the manner of the Prony brake. The advantages claimed for this form of brake are, that since the power is absorbed electrically, there is no frictional resistance, and consequently there is no possibility of "seizing," and no violent vibrations of the lever occur. Another advantage is that no artificial cooling is required. The accuracy of this dynamometer is believed to be much greater than that obtained with any purely mechanical form of brake. A 35-H.P. dynamometer, tested by Prof. Weber, of Zurich, measured from 5—10 H.P. with a precision of 1 per cent., from 10—20 H.P. with a

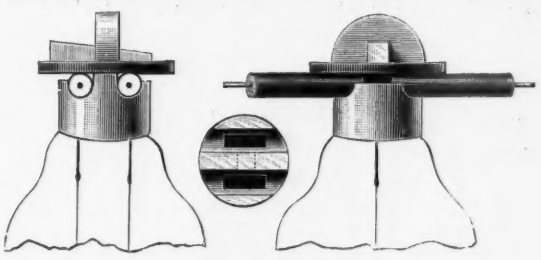


Rieter Absorption Dynamometer.

precision of ·03 per cent. to ·03 per cent., and from 20—25 H.P. with a precision of ·03 to ·02 per cent. The dynamometer is the invention of Mr. E. H. Rieter-Bodmer, of Konstanz, Germany, and it is manufactured in England by the Newton Electrical Works, Limited, Taunton.

Johnson's Patent Lamp Cap.

This cap has been devised to meet the demand for a really efficient, quick, and inexpensive method of electric lighting for temporary purposes, and is being supplied by Messrs. Johnson & Fitzer, 13, Cambridge Parade, East Twickenham. It consists of a china cap having two grooves in which are the contacts, which are separated by a china wall rising above the level of the cap. Over the grooves passes a fibre cap slotted to fit over the insulating china wall. In the centre of this insulating wall a small square hole is made. When the wires have been laid in the grooves the fibre plate is slipped over and held in position by a small plug or cotter passed



Johnson Lamp Cap.

through the hole in the insulating wall. The method of connecting is as follows:—The conductors are bared for a length of about ¾ in., and a small piece of lead foil is rolled round to make a perfect contact; or another method is to have a small V spring on the lead and so press it against the wire. The lamp is held rigidly in position by the fibre plate and cotter. Where straight lengths of lamps are required, thin strips of wood can be used slotted to receive the china wall, and the lamp can be fixed by passing the cotter under the strip of wood. By this method temporary lighting can be quickly and cheaply executed.

Ediswan Electric Light Fittings.

The Edison & Swan Company are now showing, at their London and provincial showrooms, a large variety of the latest designs in

Ediswan Corridor Fitting.

artistic electric light fittings. The fittings are of the highest quality material and finish. Among them is a type of fitting specially adapted for bedroom use, for fixing over the dressing table. It is executed in the style known as *l'Art Nouveau*, and the fitting is very suitable for present-day decorations. On p. 604 we illustrate a combination standard and bracket, the many uses of which will be at once apparent. The illustration shows the fitting attached to a bedstead. It is fitted with an effective knuckle joint at the base and also at the nipple, and can thus be adapted to any position desired. The fitting can be supplied in any finish. Hammered metal fittings are now coming rapidly to the fore, and the Edison and Swan Company make a speciality of this class of metal work. They have an extensive variety of this style of fitting in their various showrooms. A specimen is shown on the next page For the

corridor such a fitting as we show on page 603, seems very suitable. The chain completely hides the wires from view, and the workmanship and finish are of the best.

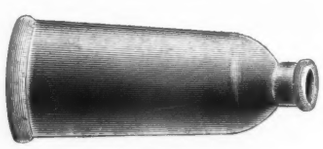
The Edison and Swan Company are also showing a large number of illuminating signs and devices suitable for decorations, &c., on the occasion of the Coronation. The designs are too numerous to admit of their being fully described here, but a visit to the company's

Ediswan Hammered Metal Fitting.

showrooms will prove that due attention has been given to illuminating appliances and devices for this auspicious event.

Rubber Sleeves for Lampholders.

The accompanying illustration shows a rubber sleeve for incandescent electric lampholders, invented by Mr. Samuel Miller, of Camden Town, and being sold by the General Electric Company, (1900), Limited. This article is designed to effect the protection of lampholders when used in the open air or in damp places, and it is, therefore, clear that it may be of some service in connection with electrical illumination work during the next few months. As the sleeve engages directly on the glass of the lamp, it prevents



rain or damp air penetrating into the interior of the lampholder, and so prevents short-circuiting. As may be imagined, it is a quite inexpensive affair, and fits over the holder as a close-fitting skin.

Electric Lamp for Photographic Dark Rooms.

Nowadays red-coloured electric lamps are largely used in the dark rooms of photographers, their convenience, as compared with gas or oil lamps, being very great. One of the drawbacks to the usual red-coloured lamps, however, is that when a white light is needed, one has to have either an ordinary incandescent lamp at hand to

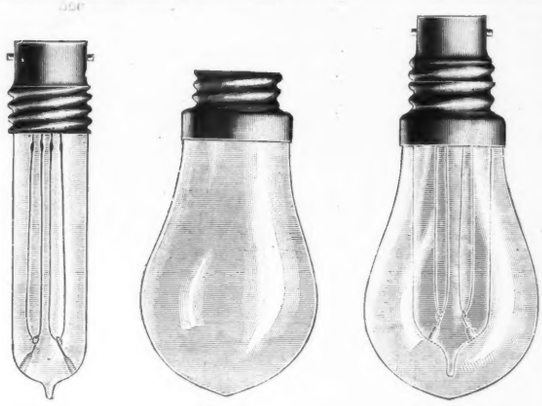


Fig. 1. Fig. 2. Fig. 3.

Electric Lamp for Photography.

substitute for the red one, or otherwise to have two lamps installed, one red and one white, with their respective switches in the dark room. Red lamps, too, are of course much dearer than the ordinary white ones, so that their renewal may become a costly item. In the new lamp recently introduced by Messrs. Siemens & Halske, of

Ediswan Combination Standard and Bracket.

Berlin, and of which illustrations are given herewith, photographers will find a useful combination of a white and red lamp. The lamp itself (fig. 1) is made with a colourless cylindrical transparent bulb, the exterior of its socket being screw-threaded. Fig. 2 shows a red-coloured glass bulb of the usual form, the open end of which is fitted with a screw-threaded piece, by means of which it can be quickly fixed over the white lamp, as shown in fig. 3. Thus the new lamp can fulfil all the functions of the usual two lamps, as, when a white light is required, all that need be done is to remove the outer red bulb. There is, also, the additional advantage that, when the lamp requires renewal, it is only necessary to purchase an ordinary white one of cylindrical form. The lamps are made with both screw and bayonet methods of socket attachments and for

Fig. 4.—Krupka & Jacoby Batten Lampholder.

various voltages and candle-powers, and are being placed on the market by Messrs. Krupka & Jacoby, of 61 & 62, Watling Street, E.C.

The same firm is stocking for the Coronation illuminations a new form of bayonet lampholder, of the simplest possible construction, and easily attached to battens for the formation of special designs. The holder is illustrated in fig. 4, while fig. 5 shows its application to the design of a crown; similar designs embodying the letters E R, &c., can be built

up, or obtained already fitted, with or without lamps, from Messrs. Krupka & Jacoby. Large numbers of these, we understand, have

Fig. 5.

been supplied to Burton-on-Trent, Plymouth, &c., for the coming celebrations.

New Switches.

Mr. H. O. Farrell, of 106, Princess Street, Manchester, is manufacturing some new switches, of which a few details follow. Fig. 1 shows a main switch, in which there is a terminal contact at each end of the movable blade, which is pivotted to, or adjacent to, one of them. A disadvantage usual to this type is that a firm rubbing contact at the pivotted end interferes with the free movement of the blade, so that excessively powerful springs have to be employed to obtain a quick-break, and these springs have to be almost necessarily of a type that is inoperative at intermediate positions. In his switch Mr. Farrell claims to have overcome these objections.

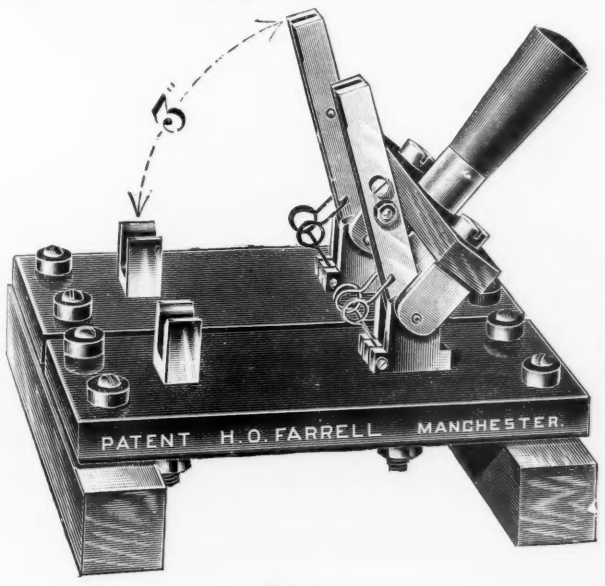


Fig. 1.

The movable blade is made up of two springy strips of brass, attached side by side in such a manner, that compression at one end of the blade tends to cause expansion at the other. This blade is adjusted so that when it is at the "off" position it is an easy fit in the jaws of the slotted contact to which it is pivotted. When the blade is moved to the "on" position, as soon as the end enters the jaws of the other contact, the compression causes a strong rubbing contact at the pivotted end. In opening the switch, immediately the blade is clear of the jaws of one contact, the pressure is entirely relieved at the other, allowing the spring to act effectively. An advantage of the design is that, should a spring at any time require renewing, it can readily be replaced without dismounting or taking the switch to pieces. Another feature is that the blades are adjustable, so that the contact pressure can be varied, or wear taken up.

Figs. 2 and 3 illustrate Farrell's tumbler switch. This is of the usual tumbler type as regards the movement of the handle and general external appearance, but the internal mechanism is an entirely new departure, and is claimed to possess distinct advantages. The contact bar is attached to a cylindrical piece of china with a spiral groove along its length. The action of the switch is as follows:—In moving the handle piece to the "on" position, an

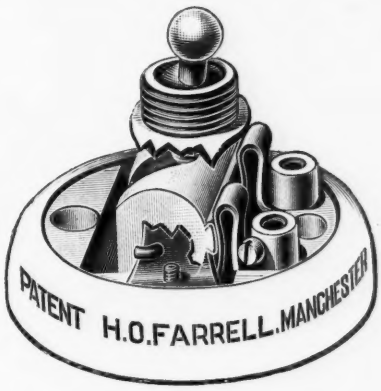


Fig. 2.

extension of it engaging in the spiral groove forces the cylinder to rotate until the contact bar makes connection with the terminal contacts. (See fig. 2.) In breaking the circuit a spring rotates the cylinder a half-circle, bringing the contact bar round to the side removed from the terminal contact, as shown in fig. 3. This is a "snap off" action, independent of the speed at which the handle is moved. The maker claims the length of the break to be greater

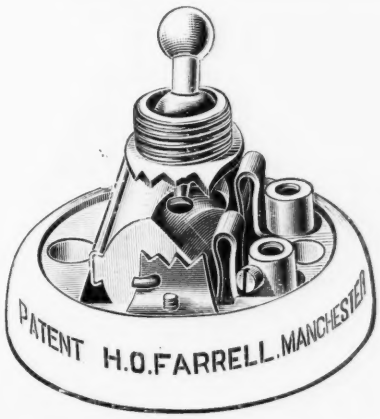


Fig. 3.

than in any other switch of the same size, and that the china body of the cylinder intervenes across the path of any possible arc, except between the terminals themselves. The parts are few in number, simple and strong, and we are informed that the device has been severely tested as to durability with most satisfactory results.

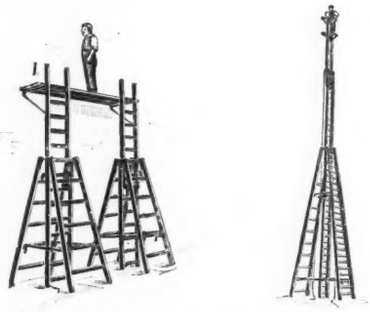
Folding Scaffolding for Wiring Work.

The latest improved telescopic folding scaffolding which is being made by Mr. J. H. Heathman, of Rectory Road, Parson's Green,

Heathman Ladders.

S.W., may be of great service in connection with the wiring of building exteriors for the forthcoming illuminations, and renders the rigging up of old-fashioned scaffolding quite unnecessary. The

scaffold all folds up and detaches as well as adjusts at different heights, while the trestles may also be used detached from the ladders. We understand that Mr. Heathman has already supplied

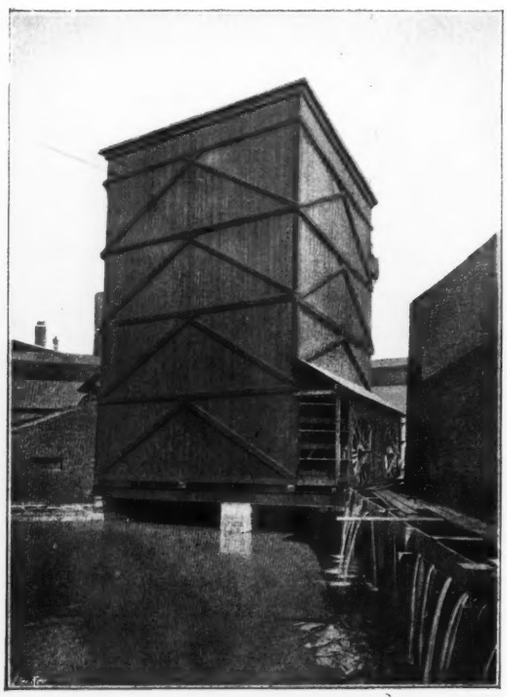


Heathman Scaffolding.

a set of 50 ft. height for the Hackney Empire Theatre, a 30 ft. set for the Bow Vestry Hall, and a 40 ft. set for the Great Central Hotel.

Sheffield Cooling Tower.

Mr. Arthur Koppel, of 27, St. Clement's Lane, E.C., the British agent for Balcke's patent condensing and water-cooling plant, has erected for the Sheffield Corporation Electricity Supply Department a wooden fan-draught cooling tower capable of dealing with 180,000 gallons of water per hour. There are four fans, each one supplying draught to a walled-in compartment; they are driven in pairs by two shafts which run right through the tower. These fans are 10 ft. diameter, and run at 180 revolutions per minute. The shafts are driven by belt from two-phase 50-period motors running on a 200-volt circuit. There are two motors, each of 30 B.H.P., built by the British Westinghouse Manufacturing Company, Limited, each motor driving two fans.



Balcke's Cooling Tower.

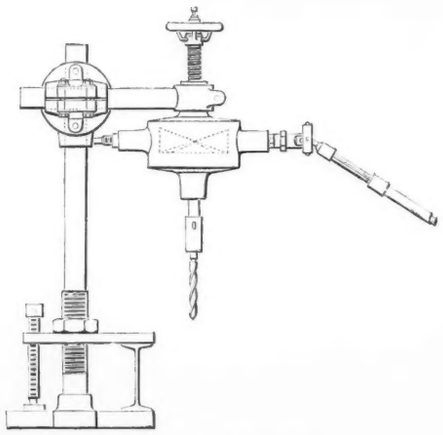
There is also a centrifugal pump by Gwynne & Co. to lift the water 36 ft. into the distributing trough. This pump is driven by a 75-B.H.P. motor of the same class. It is thought that, but for this cooling tower, the works would have been unable to cope with the demand during the very dry season which was so prevalent up in Lancashire and Yorkshire last summer. The tower is built entirely of wood, the main uprights being 8-in. square pitch pine. The arrangement for equally distributing the water over the whole surface of the tower is ingenious. The tower is arranged so that it can, on small loads, be run with natural draught, flap boards and doors being built into the fan casing which can be opened and closed accordingly. The matter of rain from the excessive vapour has been to a large extent modified by carrying the tower higher above the troughs than has been the general practice; and there are a number of rows of baffle boards through which the vapour has to fight its way, thus losing much of its dampness. Another point to be mentioned in connection with this tower is, that the whole has been built over an existing cooling pond, the girder foundation work being slung from side to side of the pond with spans of 30 ft. The girder work in itself is a difficult mechanical construction, considering the slack state of the earth prevailing in that part. The weight of the tower when at work being 90 tons, it is claimed to be quite a unique achievement. The foundations were built by the electricity works employés to drawings prepared by the engineer and the contractor.

Portable Electric Drill.

The Lahmeyer Electrical Company, Limited, New Oxford Street W.C, are supplying portable electric drilling machines for drilling castings or heavy machinery. They are built in two forms, viz.:—(1) Motor and drill separate, coupled by means of flexible shaft or telescopic spindle with two universal joints; (2) Motor and drill combined, for drilling vertically, the drill being driven by means of belting.

Other drills for special purposes or for outputs which are not specified in the company's recently-issued list can be supplied. The complete equipment consists of a motor and trolley, connecting spindle and drill. The drill consists of a pillar with base cross bar, tool-holder and the drill itself; the necessary gearing is completely enclosed (see illustration). The pillar can be supplied with different forms of bases, either plain, or provided with screw nut bar and tightening device, as shown; the cross bar can also be arranged so as to be movable, enabling the drill to be fixed at any angle to the upright pillar.

The motor, completely enclosed in a cast-iron case, is fixed on a trolley, on which are also fixed the starter, cable drum with six yards of flexible cable, plug switch, D.P. fuse and the necessary gearing for driving the connecting spindle between motor and drill. By



Lahmeyer Electric Drill.

means of a lever and clutch coupling the gearing can be changed whilst the motor is running, from a ratio of 1 : 4 to 1 : 8. When the lever is in the middle position, the spindle is disconnected; on turning to the right or left, the spindle revolves slowly or quickly.

The trolley handle can be used in the ordinary way for moving the trolley from place to place, and when placed vertically the trolley can be suspended from a crane or blocks, &c. The telescopic spindles are made of best steel, the universal joints been hardened. These spindles are capable of transmitting the power even at wide angles from the horizontal. The shortest lengths of the spindles are 48 in. and 53 in. When drawn out the lengths are 73 in. and 80 in.

Richardson Arc Lamp.

Mr. A. W. Richardson, of Skew Bridge Works, Patricroft, near Manchester, is supplying open and enclosed arc lamps, which he claims to possess all the essential features of a first-class lamp, but to be produced at a low price to compare with foreign makes, special machinery, tools and appliances enabling this to be done. Fig. 1 shows the mechanism of the I.R. non-focussing type, which is simple and sound in construction. It is a differential direct-acting arc lamp, having a simple yet very positive and sensitive feeding arrangement which acts upon the carbon direct, all complications such as racks, rods, chains, &c., being entirely dispensed with. This feeding arrangement is actuated by a pair of solenoids of large area, the cores of which are attached to a rocking lever, which works the centre tube to which the feeding gear is fixed.

This gear is fitted in a box below the lamp bottom plate and so protected. The whole is constructed of a metal which will withstand the action of the atmosphere, and not corrode away. Every possible precaution has been taken to provide against the carelessness of attendants. The remains of the positive carbon is used in the

Fig. 2.

egative, therefore there is only one waste end instead of two. Being very short over all, the lamp may be used in low buildings. The lamp is specially suited to shop lighting, and for workshops or foundry work. Fig. 2 is an outside view of the same lamp. Fig. 3

Fig. 1.

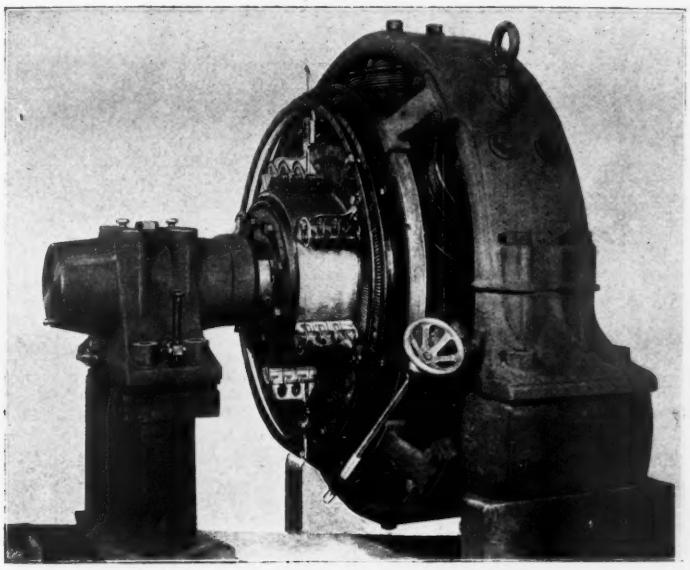
Fig. 3.

illustrates the maker's enclosed long-burning arc lamp for direct current; it has been designed and constructed on the same lines as the I.R. non-focussing type. All of the lamps are suitable for temporary lighting, the non-focussing open type lamp more especially.

The Scott & Mountain Engine-Type Generator.

The illustration represents Messrs. Ernest Scott & Mountain's latest type of generator for direct coupling to high-speed or slow-speedengines, this type of generator being constructed in all sizes. It will be noticed that the armature is of the slotted drum type, with former-wound embedded conductors, the conductors being laid in the slots after being carefully insulated. The core is composed of steel plates of high magnetic permeability mounted upon a cast-iron centre with driving slots; cast-iron cramping plates are fitted at each side, which not only keep the core plates in position, but also carry the ends of the armature conductors.

The commutator is of hard-drawn copper insulated with mica,



The Scott & Mountain Engine-Type Generator.

and is mounted on a centre which is bolted direct to the armature core, so that the whole is positively driven, and the spindle can be removed if required. The magnet frame is of steel, with internal poles; this type of machine is made with four poles in the small size, and up to 16 poles in the larger sizes. The poles are cast separate from the yoke, so that they can be withdrawn sideways, and the magnet coils removed if required, the poles being secured to the yoke by turned steel bolts. The yoke is in halves, so that the top half can be removed to expose the armature. The brush gear is supported by brackets bolted to the yoke, and the ring supporting the brush-holders is rotated in these by means of a screw and handwheel. The brush-holders are of special design to take carbon block brushes, and each is fitted with springs to vary the pressure of the carbon block on the surface of the commutator, and also with vertical movement, so that any wear of the commutator can be taken up. These generators are designed so that the temperature rise after a run for six hours at full load will not exceed the temperature of the surrounding atmosphere by more than 70° F., and the machines are capable of withstanding an overload of 25 per cent. for two hours, or a temporary overload of 50 per cent. for short periods without adjustment of brushes.

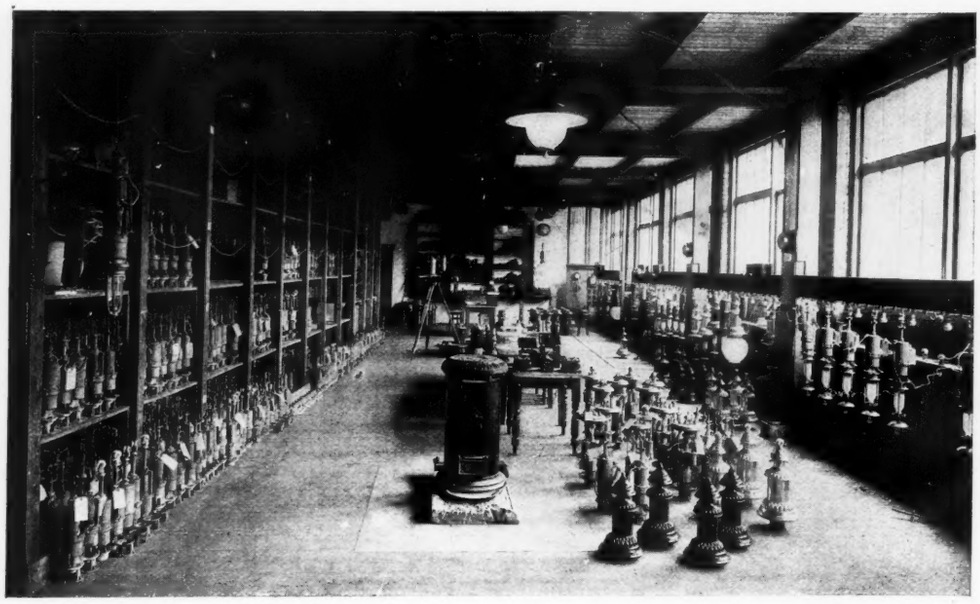
Electric Light in St. Paul's Cathedral.

The most important and costly installation of electric lighting fittings in this country, we believe, is that which is now in progress in St. Paul's. At present only the choir has been completed, and this portion of the installation was appropriately inaugurated on Easter Day, after a preliminary trial at evensong on Easter Eve; the remainder of the work will be finished, it is hoped, by Whitsuntide —at any rate as regards the lighting of the dome and nave. It has been stated in the daily Press that the work has been delayed through the non-delivery of the fittings, but this is a mis-statement, as the latter are already within the Cathedral precincts, and are awaiting permission to erect. The choir is illuminated by six fittings, suspended from the roof by means of gilded tubular rods. Each fitting carries six incandescent lamps for ordinary lighting, but, in addition, there are a number of lamps hidden from sight, which light up the upper parts of the fittings, and also illuminate the vaulted roof; the latter are controlled independently of the former. The fittings themselves are gilded, and are of very beautiful design and workmanship. Appropriately enough, the appearance of a crown is worked into the design. Eight pendant fittings will be required for the dome, and the nave will be fitted with lamps on standards. Various minor fittings for reading desks, &c., in the choir are also in use. We are unable, at present, to give illustrations of the apparatus, but we may note that the whole installation was planned and carried out, and all the fittings made at their works at Chiswick, by Messrs. W. A. S. Benson & Co., Limited, 82 and 83, New Bond Street, W The major fittings were designed by the architect.

The Jandus Arc Lamp Works.

Owing to the growing demand for their productions, the Jandus Arc Lamp and Electric Company, Limited, found it necessary in 1899 to extend the scope of their operations, and acquired the extensive premises in Hartham Road, Holloway, which they now occupy. We recently had the pleasure of visiting these works, of which the following is a brief description.

The works were opened in July, 1899. The buildings cover an area of 15,000 sq. ft., forming three sides of a square, with a spacious yard for storage and loading carts, &c., and provide accommodation sufficient for 300 men. The plant installed is sufficient for the manufacture of 12,000 standard lamps per annum, but the output could easily be increased to 20,000 lamps.

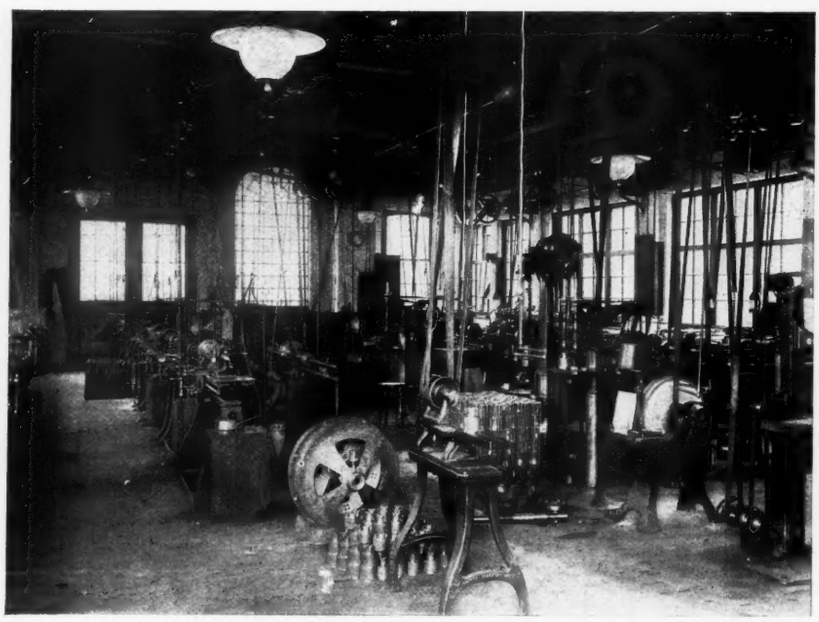


Testing Room.

In laying out the works, Mr. Adrian Jones, the works manager, went into the question of electrical driving, but found that, owing to the small amount of power required and the short distance over which it had to be transmitted, the balance of advantage rested unmistakably with a steam engine and shafting. A 50-h.p. horizontal single-cylinder engine, by Messrs. Galloway, Limited, was put down, with a Lancashire boiler of the same make. The boiler house is provided with two duplex feed pumps, and a large feed water heater. The engine only works up to its full power when driving a dynamo for lighting the shops, as well as the shafting. The latter consists of 381 ft. of 2-in., $2\frac{3}{8}$-in. and 4-in. shafting and takes 6·34 h.p. when the machines are idle, or roughly, 0·011 h.p. per foot length of 2-in. shafting. Special attention is given to the bearings and alignment of the shafting, and the engine is frequently indicated in order to keep them up to the mark by checking the power absorbed.

An E.C.C. dynamo is used for lighting the shops, charging the storage battery, and testing arc lamps; two small dynamos are also provided, which are run in series for testing lamps on 500-volt circuits.

The arrangements for testing alternating current lamps are of special interest; owing to the difficulty of obtaining just what he wanted at a reasonable price, Mr. Jones designed a small alternator, and had it constructed in the works. The armature is of the iron-cored type, and the revolving field of the Kapp single-coil claw pattern. A small drop of E.M.F., with increase of current, was essential to success, and was satisfactorily secured by magnetically saturating the iron of the field magnet at all times. The alternator



Light Machine Shop.

is provided with stepped pulleys, to give five different frequencies from 40 to 100 cycles per second, and in order to obtain suitable voltages at each of these frequencies, without varying the excitation very much, the terminals of the stationary armature coils are connected with regulating switches in the test room, so that a greater or less number of them can be joined in series as required.

Passing by the packing sheds, packing and oil stores, and the forge for tools, we come to the stores for castings and stampings, comprising the heavy parts of the Jandus lamps in the

Heavy Machine Shop.

rough; every part is systematically numbered on the drawings, &c., so that no confusion can possibly arise in making out requisitions. A stock of no less than 50,000 globes is carried; these are mostly opal or opalescent, but a great improvement in the latter type has been effected by making them, not of glass containing foreign colouring materials, but of glass containing myriads of minute bubbles, so that the light is not absorbed, but dispersed, with trifling loss.

The large test room and repairing shop comes next; this has been fitted up with the necessary switchboards, using Nalder and Evershed instruments, and with a long arc-lamp testing bench. The latter is so constructed, that a set of instruments mounted upon a wheeled carriage can be run along the top of it; as it arrives at each lamp the instruments are automatically connected in circuit, so that the current and pressure readings for half-a-dozen lamps can be taken in half as many minutes, without interruption or variation of their operation for a moment. In addition, the bench is divided into sections, each equipped with a permanently connected voltmeter, so that sets of lamps can be tested at different voltages simultaneously, and on both A.C. and D.C. circuits.

Testing transformers giving pressures up to 3,000 volts in steps of 200 volts, with plug switchboards, are provided; these were made in the Jandus works, as also are all the transformers and choking coils used with the lamps. The transformers are designed with considerable magnetic leakage, so as to act somewhat as chokers. A large stock of transformers is carried, but the extraordinary variety of frequencies in vogue is a very troublesome factor in this department. The choking coils are provided with cores whose position can be varied to meet requirements. The A.C. lamp is similar in most respects to the D.C. lamp, apart from the necessary modifications, such as the lamination of the iron core, &c.

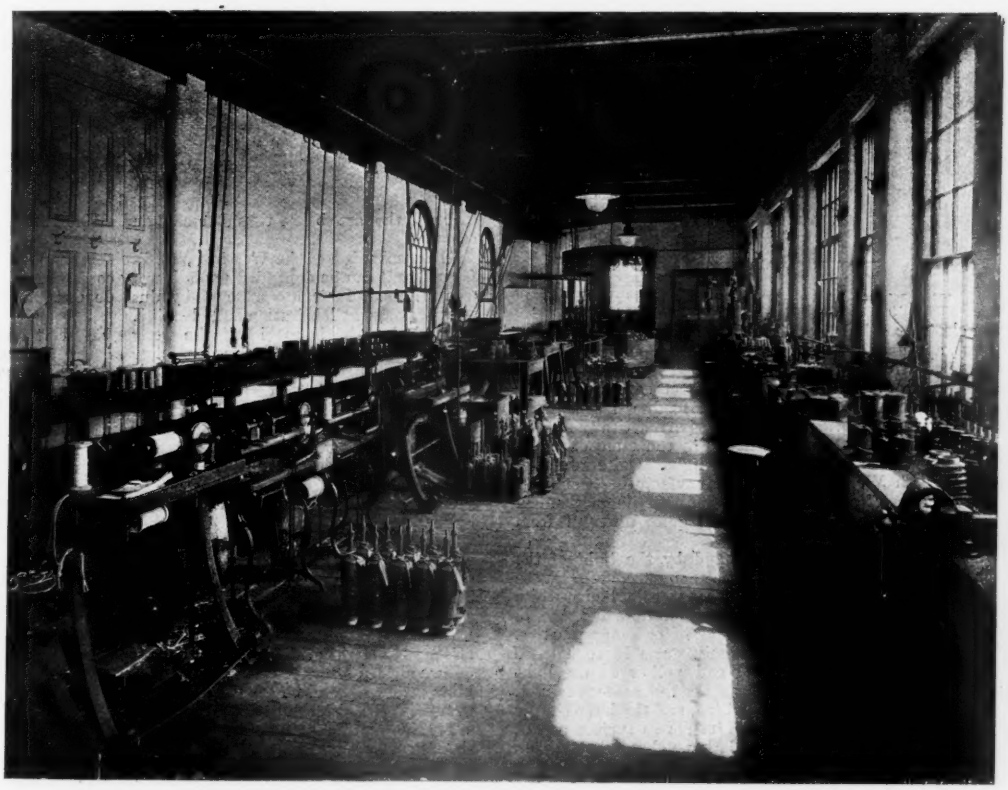
The automatic cut-outs made in the works embody several details of great interest; amongst these we may note the contacts, which are of carbon and silver—a combination probably unique, and found to be most satisfactory—and the slanting spring, which gives a practically uniform pull over a very long range without taking up much room, and can be made of stout wire without becoming too strong.

Another novelty, of no little importance, is a system of constructing the series coils of the lamps so as to be practically fireproof. This is accomplished by the liberal application of a special composition, and the result is that a standard lamp may be short circuited on 200 volts, the current rising to 25 amperes and the coil becoming practically red-hot—yet the latter is uninjured. The lamps are subjected to severe tests of this kind, being short circuited on 220 volts, and shunt coils being subjected to a P.D. of 300 volts.

The direct-current switchboard in the test room is fitted with apparatus for the control of three storage batteries, each consisting of 66 D.P. cells; these sets can be charged singly or two in parallel. Six ammeters and five voltmeters and a formidable array of plugs and switches provide for the use of all the voltages and combinations that can possibly be required.

As will be seen in our illustration, a large number of finished lamp mechanisms of all the types standardised, as well as of transformers, choking coils, cut-outs, &c., are kept in this room. Every lamp has to pass through a double series of prolonged tests, in the first of which all adjustments are made, while the second series constitutes a check upon the first, and renders it absolutely certain that no lamp shall leave the works unless it is in perfect running order. All these tests are fully recorded—a wise precaution.

Passing the case-fitting shop, where a large store of finished parts is kept, we enter the heavy machine shop. Here, it is interesting to note, the limit gauge system is in use. All the gauges are made on the premises, the limits being fixed according to a system devised by Mr. Jones. Great accuracy is essential in the construction of the lamps, and it is found that the accuracy attainable with capstan lathes is insufficient; boring, tapping, &c., are done for the most part with special tools held in rigid holders.

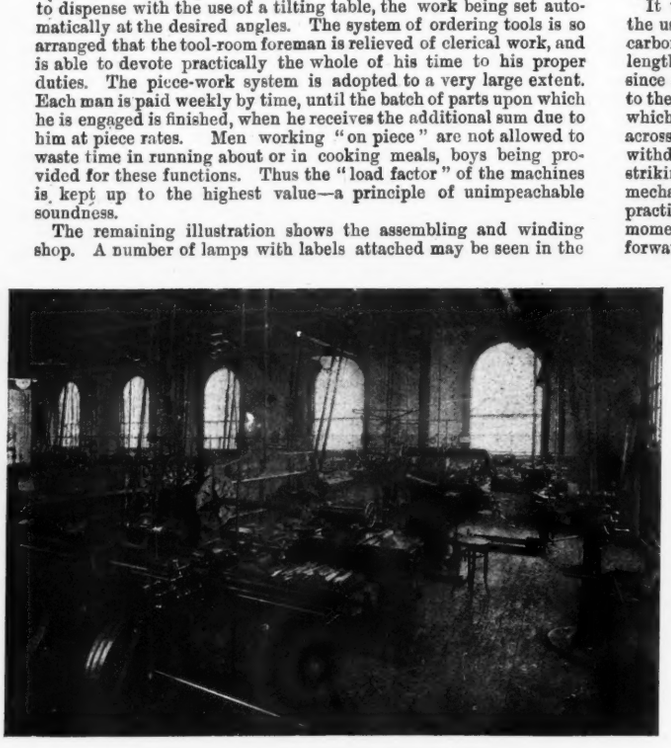


Assembling and Winding Shop.

The light machine shop and the tool room form the subjects of two of our illustrations. In the tool room nearly all the tools used

in the works are made, as well as a variety of special jigs, some of which are very complex and costly. The latter are arranged so as to dispense with the use of a tilting table, the work being set automatically at the desired angles. The system of ordering tools is so arranged that the tool-room foreman is relieved of clerical work, and is able to devote practically the whole of his time to his proper duties. The piece-work system is adopted to a very large extent. Each man is paid weekly by time, until the batch of parts upon which he is engaged is finished, when he receives the additional sum due to him at piece rates. Men working "on piece" are not allowed to waste time in running about or in cooking meals, boys being provided for these functions. Thus the "load factor" of the machines is kept up to the highest value—a principle of unimpeachable soundness.

The remaining illustration shows the assembling and winding shop. A number of lamps with labels attached may be seen in the



Jandus Works: Tool Room.

foreground, and in this connection we may call attention to another instance of the extreme care and minute detail with which the works manager has organised the work. The labels are of three different colours, so as to show at a glance what is to be done to a lamp; when it is finished, and when tested; also the work slips are coloured to show three degrees of urgency, and there is a system of order cards by means of which the works foreman knows exactly what he has to give out, which jobs must have precedence, and so on, without loss of time. Thus the foreman is never in doubt as to finding work for a man who has completed an order. If no "very urgent" orders are waiting, he gives out "early" or "stock" orders, according to the requirements indicated by the system. It is only by close attention to detail that commercial success can be attained, and the Jandus works form a conspicuous illustration of this truth.

The Westinghouse-Bremer Lamp.

Practice in electric arc lighting has changed very little during the past few years, and until quite recently, it appeared as if the working principles had arrived at a final standard. The majority of the many arc lamps placed on the market differ from each other only in mechanical details—in their striking and feeding mechanisms, &c.—they all work on one principle, and all give practically similar distributions of light from the arc, and require the same expenditure of electric power per candle-power of light. Quite recently, however, the British Westinghouse and Manufacturing Company introduced a new type of arc lamp which, both in its mechanical construction and in its working principles, is quite different from all others.

There are two or three features exhibited by the light of the Westinghouse-Bremer lamp which are noticed at once, even by the most casual observer. The light is not of that cold bluish-white colour, common to most other arc lamps, neither does it emanate from one dazzling, brilliant point as is usual in ordinary practice. The light produced by this lamp is decidedly warm in tone, there being a considerable proportion of red and yellow in the light emitted; there is no definite point apparent as the source of light, but the whole of the globe is evenly lighted, and the lamp simply appears as a luminous ball, diffusing from its entire surface a soft, warm light. There are no shadows or dark patches whatever on the lamp globe, and the shadows thrown by the light are not dense and black, since the light emanates from a large surface, and not from an exceedingly bright point. The globe is quite free of any length of carbon, slides, carbon-holders, &c., below the arc; consequently, there are no shadows projected on to the globe. The arc is situated in a fixed position at the top of the globe under a small reflecting hood. Both carbons project from above into this reflector for a distance of about 1 in. Neither of the carbons is vertical, they are inclined to each other at an angle of about 20°; they are, however, so nearly vertical that a gravity feed is utilised. The arc is horizontal across the two ends of the carbons; it is prevented from rising up the sides between the carbons, and is caused to assume a downward curve of a peculiar form between the ends of the carbons by an ingenious electro-magnetic arrangement.

It will be seen that, owing to the small angle between the carbons, the usual method of striking the arc by momentarily bringing the carbons together, and then drawing them apart to form the correct length of arc, is hardly practicable in the case of the Bremer lamp, since a long and uncertain fall and return would require to be given to the carbons. The arc is started by an additional striking piece which, at the instant of closing the lamp circuit, is put forward across the two carbon ends, short-circuits them for an instant, and withdrawing, leaves the arc formed between the carbons. This striking arrangement works in conjunction with the carbon feeding mechanism; the combination is simple, and works excellently in practice. Any tendency of the arc to become too long, or any momentary break of the arc, is followed immediately by the moving forward of the striking piece, and the downward feed of the

The Westinghouse-Bremer Lamp.

carbons, the arc being thus corrected and maintained normal and constant.

The mechanism of the Westinghouse-Bremer lamp is of such a form that it can be depended upon to work correctly and definitely at all times. It is not affected by dust deposits, and does not require frequent lubrication and cleaning.

On closing the lamp circuit, the wedge-shaped striking piece is moved forward by the upward motion of the armature of an electro-magnet, which also controls the carbon grips, so that the downward feed of the carbons follows close after the forward motion of the striking piece. The carbons thus feed down by gravity on to the striking piece, and an arc is formed between the striking piece and the carbons. The coil of the striking electro-magnet is at once thrown out of circuit, the carbons are re-gripped and the striking piece withdrawn, leaving the arc burning between the two carbons. The downward feed of the carbons is graduated to a nicety by means of gravity-controlled contacts working in conjunction with the striking electro-magnet. The action of feeding and striking works with equal facility and precision, whether the lamps be wired singly on circuits or whether there be a number of lamps in series. The carbons are so nearly parallel that the arc continues to burn steadily at a practically constant length for some time. The carbons feed usually at intervals of about a quarter of an hour, and the effect on the light of the lamp when feeding is almost inappreciable.

Two electro-magnets are so arranged that the centre of the arc is blown down between the carbon points and also projected towards the sides of the reflecting hood; a fan-shaped arc is the result, and, aided by the reflecting properties of the hood, the light is produced more in the form of a luminous ball than an intensely brilliant point, such as occurs in ordinary arc lamps. One of these arc-controlling electro-magnets is single-wound, and is in series with the arc; the other is compound-wound, having a coil in series with the arc and also a shunt coil coupled across the lamp terminals. The two windings are coupled so as to oppose each other. The series magnet is arranged so that one of its poles just enters the hood between the carbons and above the arc. The two poles of the compound magnet are of semi-circular form, and encircle the lower outside edge of the reflecting hood; they are thus outside the carbons and below the arc. The effect of this magnetic arrangement on the shape of the arc can easily be understood, the downward centre "draught" of the one magnet, combined with the

upward side "draught" of the other, tending to give the arc the peculiar and desirable fan shape just mentioned.

As the arc continues to burn, the carbons are consumed, and the arc tends to lengthen, so that the lamp current tends to decrease; the effect of the series magnet is, therefore, reduced, and the arc is allowed to ascend nearer the carbons. The series current of the compound magnet is also reduced, and its effect is further reduced by the increase in the current through its shunt coil, owing to the increase in resistance of the arc raising the pressure at the terminals. This weakening of the lower magnet reduces the lateral spreading of the arc, and, as it ascends the cone, following the carbons as they are consumed, it is just spread sufficiently to maintain its correct fan shape and respective position as to the sides of the reflecting cone at points of reduced diameters. It is claimed that this ingenious means of regulating the arc produces an absolutely steady light.

The electrodes or carbons used in the Westinghouse-Bremer lamp are a feature peculiar to this lamp. They are not of carbon or graphite alone, but are composed of a mixture of carbon with certain minerals, whereby the high light efficiency of the lamp is mainly secured. The presence of these minerals in the carbons improves the value of the light in three ways:—The vaporising of the minerals increases the brilliancy of the arc; the arc formed is of better electrical conductivity than that formed between electrodes of carbon alone, consequently a stable arc of long length is secured, giving the best diffusion of light; the mineral vapour condensing on the inside of the cone and around the arc forms an excellent permanent snow-white reflector; and the colour of the light emitted is warm and pleasing, quite different from the cold bluish-white light yielded by an arc between pure carbon electrodes.

The lamps are manufactured in sizes for various currents and for long or short hours of burning with one supply of carbons. The carbons are of various diameters to suit the different lamps. The lamps and the carbons are protected by patents.

Such are the more important features of the new Westinghouse-Bremer arc lamp. There are other advantages which it possesses, such as, for instance, those which deal with the renewal of the lamp carbons. For this purpose there are no screws or clamps to manipulate, the globe has not to be removed, and the carbons require no adjustment, either for alignment or length; the carbons are simply dropped into tubes from above; the tubes are large, and the carbons fall easily into position. Thus carbon renewals can be put into the lamp whilst the lamp is in operation, and carbons of any length—even short, broken pieces—can be used, and there is no waste of carbons. But sufficient has been said to show that its design has been worked out with the idea of leaving no feature of the ordinary arc lamp unimproved. Practice has demonstrated the complete success of these efforts, and the introduction of the Westinghouse-Bremer lamp marks an important advance in the field of electric lighting.

ELECTRIC TRACTION NOTES.

(*Continued from page* 594.)

Merthyr.—The Merthyr Electric Traction Company have given the D.C. notice of their intention to apply to the B. of T. for an extension of time until 1903 for the purpose of constructing the works authorised.

New Malden.—The U.D.C. is informed that the proposed L.U.T. line over Kingston Hill has been withdrawn.

Newport (Mon.).—It has been decided by the Newport Electrical Committee to make every preparation to proceed with their scheme of reconstruction of the tramway system as soon as the Corporation Bill now before Parliament shall have received Royal Assent. The borough engineer suggests that Hadfield's manganese steel shall be used for the points, crossings and junctions throughout the lines, and that quotations for this work shall be obtained, and that for the lay-out line in the yard competitive tenders be obtained for manganese and crucible steel; that "anchor" shall be used as preferable to the ordinary flat plate; that various points and sections of rails shall be renewed, and that broken stone shall be used for the concrete to be laid under the setts. These suggestions have been approved.

Oldham.—During the Easter holidays the cars running from Middleton to Chadderton and Castleton carried an immense number of passengers. These tramways were only opened on Thursday week, and in three days carried 60,000 passengers.

Richmond—Hampton Court.—The L.U.T. track is laid between Richmond Bridge and Twickenham, but sundry widenings have yet to be completed. Most of the posts are in position.

Salford.—In connection with the tramways the new route between Weaste and Trafford Bridge was opened on Friday last. It is expected that the Sussex Street, Lower Broughton Road and Cliff lines will be ready shortly. It was hinted that there might be through running between Salford and Stratford in the not very distant future.

South Shields.—The tramways question is still agitating the South Shields Council, and at their meeting on 2nd inst., the report of the Parliamentary Committee recommended that the South Shields, Sunderland, and District Electric Tramways Bill be opposed by petition to the House of Lords, and that the Committee have power to negotiate with the promoters of the Bill, if possible, to agree upon clauses for the protection of the Corporation, or if they think fit, to oppose the Bill before the House of Lords Committee. This suggestion was opposed by Mr. W. E. O. Scott, who thought it would be better if, after negotiations had been tried and failed, they had another meeting of the Council. He deprecated another expensive fight in London. He was of opinion that the Council did not occupy a strong position, seeing that their own Bill had been defeated in the town by a poll. It was not in the public interest that this Bill should be defeated. A warm discussion ensued, which was spiced with a good deal of personality, but eventually the Committee's report was adopted unamended.

Spain.—The Medina—Zamora Railway Company is preparing plans for a projected electric railway between the Incio mines and San Estebau. The line will be a narrow gauge one, and is intended for the transport of ore from the province of Lugo to the port of Vigo.

Sunderland.—The Sunderland Electric Tramways Committee are experiencing some difficulty in regard to the transfer tickets which they issue, enabling the holder to pass from one section to another without further payment. The system is worked out roughly on the principle of a mile per 1d., and the system of transfers was instituted to allow a traveller who got on to the car in the middle of one of these 1d. sections to pass to the middle of the adjoining section. The Committee are finding, however, that there is a vast deal of cheating by the unscrupulous, and at the last Committee meeting some figures were given bearing this out. It was shown that on the Hendon route on which the transfers are mostly used, during a certain period 127,000 passengers were carried, and the financial return was 8·4d. per car-mile. On the other hand, on the High Street and Hylton Road route, where few of these transfer tickets were used, the number of passengers carried in the same period was 126,000, and the money return 16·1d. per car-mile, or very nearly double that of the Hendon route. A suggestion was made to do away with the transfer system, but eventually the matter was adjourned.

Switzerland.—The Oerlikon Maschinenfabrik, of Oerlikon, is reported to be in negotiation with the Swiss State Railway authorities for the experimental installation of electric traction on the Seebach—Wettingen railway, which is about 20 kilometres long.

Tipton.—An agreement has been entered into between the U.D.C., the British Electric Traction Company, the Birmingham and Midland Company, and the South Staffordshire Company, whereby, within two years, the tramways in the Council's district will be taken over and electrically equipped. The tramway companies are to pay the Council a lump sum (not disclosed) down and £150 per year from the date of the agreement. There are also to be workmen's fares, and waiting rooms are to be provided, and if any damage is done to gas mains, the Council are to be entitled to full compensation. If the Bill before Parliament for dealing with the tramways which the Council are promoting is dropped, the tramway companies will pay the whole of the costs of promoting. At a meeting of the Council on Wednesday last week this agreement was sealed, and it was resolved to drop the Parliamentary Bill.

West Bromwich.—The T.C. has consented to another application by the South Staffordshire Tramways Lessee Company, for a further extension, but only for nine months, for the use of steam on their system.

Windsor and Maidenhead.—The Light Railway Commissioners further considered this proposed light railway scheme on Tuesday at Windsor, and the order was refused, the promoters not having sufficiently proved their case in the opinion of the Commissioners.

Worthing.—The General Purposes Committee is to report upon the best steps to be taken to obtain powers for the construction of electric tramways within the borough, and to such places adjacent thereto as may be deemed expedient.

TELEGRAPH AND TELEPHONE NOTES

Brighton Telephones.—A Local Government Board inquiry was held by Colonel Slacke, R.E., at Brighton, on 2nd inst., when the Corporation produced evidence in favour of an application to be allowed to borrow £45,000 for the establishment of a Telephone Exchange System with 2,000 subscribers. Major-General Webber was examined in support of Mr. A. R. Bennett's plans and estimates for the work. We understand that the tenders actually received, together with other costs, allow the estimate of capital expenditure per subscriber joined up to be placed at £19 6s., which gives an average length of 1¼ mile for each twin wire line. It may be interesting to mention the time that has elapsed between the date when it was decided to apply to the Postmaster-General for a telephone license and when a system has been constructed and

put to work. Thus, although Glasgow began to move in the question in 1896, the present Municipal Exchange, which has about 4,500 subscribers, was only opened in August, 1901. Tunbridge Wells, which began its active canvass also in 1896, did not commence work until July last. Portsmouth discussed the question in 1897, and only last week was the ground being broken to commence work on the system, under the scheme for which the Local Government Board held an inquiry in November, 1901. And now, the Corporation of Brighton, which moved first in the matter so long ago as 1898, was only last week ready to submit its proposals to inquiry.

Durban Telephones.—The Corporation have instructed their electrician to report on the system most suitable for the town, they having acquired the plant of the Natal Telephone Company. He will confer with the Johannesburg electrical engineer, so as to ensure, if possible, the adoption of a similar system for both cities.

Glasgow Telephones.—The first year's operations were completed on the 2nd inst., and the convener of the Telephone Committee, Bailie James Alexander, at the meeting of the Corporation on 3rd inst., stated that the general manager reported that they had now 4,524 subscribers connected. New orders were coming in, he was pleased to say, spontaneously, and the number in the books amounted to 6,767. Govan Exchange was opened last week, and Shettleston would be opened in a few days. The other exchanges at Clydebank, Rutherglen, Cambuslang, Leuzie, and Kirkintilloch were also well under way.

At the same meeting of the Corporation, Councillor Carvick Webster put the following questions to the convener of the Telephone Committee:—(1) Has he seen the report of the inquiry before the Local Government Board regarding the Tunbridge Wells telephones? (2) Is Mr. A. R. Bennett, whose cross-examination appears, the same gentleman who is general manager for the Glasgow Corporation Telephone Department? (3) If so, is he also consulting engineer to any other municipality? (4) If so, is it under agreement and with the approval of the Telephone Committee? (5) Is it a fact that he is only bound to give a portion of his time to the service of the Corporation, and if so, how much; and is the £1,000 referred to in the minute of February 15th last paid for the said portion, or is it the rate per annum at which he is paid only for the time he gives? (6) As there are several statements regarding mistakes in estimates and errors in judgment in the said report, which, it appears to me, reflect on Mr. Bennett's skill as an electrical engineer, will the convener, if he has not already done so, inquire at once to what extent, if any, similar errors may be affecting the Corporation system?

Councillor W. F. Anderson asked if the convener could inform the Corporation by whom the various anonymous printed statements on this subject had been circulated.

Bailie Alexander said the answer to each of Nos. 1, 2, 3, and 4 was "Yes"; No. 5 was "Per annum"; and No. 6, "That the Corporation were perfectly satisfied with Mr. Bennett's services."

Indo-European Telegraph Department.—The administration report of this department for 1900-1901 has just been issued. The total capital outlay to the end of that year was £771,680, and the net result of the year's working was a profit of £60,580, representing a dividend of 7·85 per cent. There was no interruption of traffic between Teheran and Karachi during the year, but between Teheran and London the lines were interrupted for a total period of rather over three days. There were 560 acts of wilful damage on the Persian section. Soon after his return from Europe the Shah issued a firman to the local governors urging the necessity for energetic action in protecting the line, but the result has not been satisfactory. Interruptions on the Turkish route occurred amounting to about 37 days, and the working of this route continues to be unsatisfactory. The Teheran—Meshed line of 568 miles, owned by the Persian Government, but maintained by the department, worked smoothly, the interruptions aggregating only 24 hours. The increased message revenue of the year was chiefly owing to the war in China. Message statistics show that during the five years to March 31st, 1901, the *Times* messages, averaging 242 words each, were five times as long as other Press messages. The average length of commercial messages was 12·95 words. The new convention between England and Persia provides that in addition to the existing line from Teheran to India *viâ* Bushire, the Persian Government shall construct under the supervision of the British Telegraph Staff a three-wire line from Kashau to the Baluchistan frontier *viâ* Yezd and Kerman, traversing, wherever possible, inhabited districts. The Persian Government agrees to lease the use and the transit revenue of the line, when completed, to the Indo-European Telegraph Department, which will provide for its maintenance and direction, though the line guards are to be Persian subjects.—*Times.*

Portsmouth Telephones.—The ceremony of laying the first conduit in connection with the Municipal Telephone Exchange was performed on Saturday at noon, in the vicinity of the Town Hall, by the Mayor, Major W. T. Dupree. In his Worship's banqueting room light refreshments were served, and Mr. Bennett, the Corporation telephone engineer, gave some explanatory details, and stated that towns and villages in the vicinity of Portsmouth would be served, the area covered embracing an area of 100 square miles. At the rate at which subscribers were coming in, provision would have to be made during the next few months for more than the 1,240 for whom accommodation was arranged. He also intimated that the Telephone Committee had made arrangements for the very best service available. Councillor W. P. Dillman, Chairman of the Telephone Committee, referred to the strong opposition which had been offered to the scheme, and expressed a hope that henceforward it would have the support of the whole community. Mr. Bennett presented the Mayor with a silver trowel and mallet, and Mr. Wilbourne, on behalf of the British Insulated Wire Company, who will carry out the cable work, with a mounted telephone cable sample, as mementoes of the occasion.

Reduction of Rates to India.—In the annual report of the Committee of the Bengal Chamber of Commerce for the past year, the following paragraph deals with the question of a reduction in the charges for Indo-European telegrams:—

"While writing this report, the Committee were glad to see from a Press telegram that the reduction in charges for telegraphic messages between India and Europe, which has been the subject of such prolonged agitation both here and at home, seems at last likely to be effected. In a paragraph under this head in the last report, the Committee placed on record the obligation which the mercantile community and all engaged in trade with India were under to Sir Edward Sassoon, Bart., M.P., for the active part he has taken in this agitation, and expressed a hope that he would continue, as heretofore, to keep the matter before the House of Commons and the British Government. The Committee have noticed from the English Press that Sir Edward Sassoon had lost no opportunity of keeping this important matter well to the front. In March, 1901, he moved an important resolution at the annual meeting of the Association of Chambers of Commerce in London, supporting it by an energetic speech, and he has on more than one occasion addressed letters to the *Times*, urging more vigorous action on the part of Government. In this connection the Committee would refer to a communication they received in August last, from the President of the Board of Trade, Ottawa, Canada, urging the importance of securing an Imperial system of telegraphy connecting British possessions throughout the world by State-owned telegraph cables, under the control of the Post Office."

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899 ..	..
Alexandria-Larnaca	Jan. 19, 1902 ..	..
Assab-Massowah	March 17, 1902 ..	..
Perim-Obock	Feb. 26, 1902 ..	..
Cayenne-Pinheiro	March 8, 1902 ..	..
Colon-Jamaica	March 13, 1902 ..	..
Zanzibar-Mombassa	March 13, 1902 ..	..
Landlines:—		
"*Via* Hanekin" on Persian territory	Feb. 24, 1900 ..	..
Communication with Baranquilla and Cartagena	Dec. 8, 1900 ..	..
Guanta-Barcelona	March 17, 1902 ..	..
Berlin-Versovic	March 31, 1902 ..	..
Barcelona-Cuidad Bolivar	March 6, 1902 ..	..

Wireless Telegraphy.—American dispatches to the daily press report that Mr. J. Pierpont Morgan's interests have secured the American patent rights of the Marconi Company of London. The new company will be styled the Wireless Telegraph Company of America. Its first work will be to establish wireless connection between Key West and Havana; if this proves successful the system will next be installed in the Philippines. Mr. Marconi has stated that the original company will carry a controlling interest in and co-operate with the American company.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—May 7th. A 20-ton electrical overhead crane for the Dee Village electricity works. See "Official Notices" to-day.

Bath.—April 21st. Steam dynamos, motor-alternator, balancer, switchgear, transformers, water softener, arc and glow lamps, cables and meters, &c. See "Official Notices" to-day.

Bermondsey.—April 14th. Arc lamp carbons, meters, oils, incandescent lamps, cables, meter-boards and stores for the electricity and destructor works. See "Official Notices" March 28th.

Bexley.—April 21st and 28th. Tram rails, fishplates, &c., also engines, alternators, and dynamos, for the U.D.C. See "Official Notices" March 28th.

Brighton.—April 14th. High-rate discharge battery, reversing booster and switchgear, for the electricity department. See "Official Notices" April 4th.

Burton-on-Trent. — April 22nd. The Corporation wants tenders for the construction of about 5¾ miles of route, single line with passing places; consulting engineers, Messrs. Kincaid, Waller & Manville.

Chili.—The Chili Legation in Paris (18 Rue Pierre Charrox) is open to receive proposals for the electric lighting of the public streets, and the establishment of a network of electric tramways in the city of Valparaiso.

Devonport.—April 16th. Permanent way, bonding, &c., for over three miles of track for the Corporation. See "Official Notices" March 14th.

Dundee.—April 14th. Motor equipments and bogies for single deckers. See "Official Notices" April 4th.

Dundee.—April 24th. Triple-expansion engine and 750-kw. dynamo for the electricity department. See "Official Notices" April 4th.

Edinburgh.—April 28th. Electricity meters for 12 months. See "Official Notices" to-day.

Falkirk.—April 12th. Three 100-kw. steam dynamos (vertical enclosed high speed engines) for the electricity scheme. See "Official Notices" March 28th.

Glasgow.—April 21st. Concentric and single main cables for electricity department. See "Official Notices" April 4th.

Halifax. — The Electricity Committee have decided to invite tenders for additional plant required for next winter. The estimate prepared by the Committee is as follows:—Two boilers, 3,200 ft. heating surface, £1,500; two superheaters, £220; two chain grate stokers, £320; steam pipes, £160; two 200-kw. rotary converters, £2,000; seven 75-kw. transformers £1,115; one high-pressure switchboard, £350; one low-pressure ditto, £225; cable, £100; contingencies, £275; total, £6,275.

Kingston-upon-Hull.—April 24th. Pipework, pumps, motors, &c. See "Official Notices" to-day.

London.—April 17th. The L.C.C. wants tenders for the electric lighting of Scotland Yard Fire Station. See "Official Notices" April 4th.

London.—April 22nd. The L.C.C. wants tenders for 48 miles of extra-high-pressure three-core lead-covered paper-insulated cables; 87 miles of low-pressure single ditto; and 14 miles dry core telephone cable for the tramways. See "Official Notices" April 4th.

London.—April 23rd. High and low-pressure switchboards at the Grove Road generating station of the Central Electric Supply Company. See "Official Notices" March 28th.

Luton.—April 25th. Distributing mains. See "Official Notices" to-day.

Lytham.—April 26th. 300-kw. plant for the electricity supply and tramways station, including battery, booster, transformers, feeders, mains, arc lamps and posts, &c. See "Official Notices" to-day.

Manchester.—April 17th. The Electricity Committee advertise for tenders for the supply, delivery, and erection at their Dickinson Street and Bloom Street stations of the following:—Specification No. 1, atmospheric exhaust pipes at Bloom Street; specification No. 2, alterations and extensions to main switchboards at Dickinson Street.

Mansfield.—May 1st. Pipework, valves and tanks for the electricity works. See "Official Notices" April 4th.

Nelson. — April 28th. Rails, overhead equipment, pillars, cable, tramcars, &c. See "Official Notices" to-day.

Oldham.—May 6th. Switchboards (lighting and traction). See "Official Notices" this week.

Penang.—April 28th. Boilers, condenser, pumps, pipes, steam dynamos and balancer booster, switchboards, batteries, cables, junction boxes, arc and glow lamps, posts and accessories, for the commissioners of George Town. See our "Official Notices" March 14th.

Rathmines.—April 24th. 300-kw. steam dynamo, switchboard and mains. See "Official Notices" March 21st.

Rotherham.—April 23rd. Rolling stock, overhead work, and permanent way, for Corporation electric tramways. See "Official Notices" March 28th.

Spain.—April 15th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders until April 15th, for the supply of 30,000 zinc cylinders for telegraph purposes. Particulars may be obtained from, and tenders are to be sent to, La Direccion General de Correos y Telegrafos, 10, Carretas, Madrid.

Spain.—April 20th. The *B. of T. Journal* last week contained notice of a call for tenders to take over and work the electric light installation of the town of Irún, which was unsuccessfully offered some months ago. Particulars at the B. of T. Offices.

Stockport.—April 23rd. One 200-kw. engine and dynamo for traction purposes. See "Official Notices" to-day.

Sudbury.—May 1st. Water-tube boiler, pipework, steam dynamos, boosters, batteries, switchboard, mains, station lighting, &c. See "Official Notices" to-day.

Swindon.—April 23rd. Feeder and distributing cables, conduits &c., for electric lighting. See "Official Notices" April 4th.

Sydney.—May 7th. Messrs. Preece & Cardew, on behalf of the Municipal Council, invite tenders for equipment of electricity works and sub-stations. Water-tube boilers, three-phase steam alternators, battery, motor-generators, stationary transformers, switchboards, &c. See "Official Notices" March 21st.

Trowbridge.—April 30th. The U.D.C. is open to receive applications for a lease of its electric lighting powers.

West Hartlepool.—April 30th. 200 to 250-kw. engine and dynamo for the electricity works extensions. See "Official Notices" April 4th.

CLOSED.

Birkenhead.—The Corporation have accepted the tender of the Electrical Power Storage Company, Limited, for the storage battery for their South End generating station.

Darlington.—The Darlington Forge Company have placed with Messrs. Veritys, Limited, Manchester branch, the order for two 250-kw. generators. These machines will be of Messrs. Veritys' "Aston" standard multipolar type, and will be arranged for coupling direct to Messrs. W. H. Allen, Son & Company's steam engines, speed 350 r.p.m., pressure 220 volts. We understand that Messrs. Veritys have numerous other orders in hand for their Aston generators, including special dynamos for direct coupling to gas engines. One of these is to be employed for supplying a portion of the current to the forthcoming Exhibition at Cork.

Dewsbury.—The Electricity Committee have instructed the engineer to order a portable battery for testing purposes from Messrs. Kelvin & White, of Glasgow.

Ilford.—The following tenders have been accepted by the U.D.C. for the twelve months ending March 31st, 1902:—

Meters (ordinary type)	British Thomson-Houston Co., Ltd.
„ (prepayment type)	Geipel & Lange.
Demand indicators	Reason Manufacturing Co., Ltd.
Incandescent lamps, 8, 16, 25, & 32 c.p.	British Thomson-Houston, Co., Ltd.
Oil	Vacuum Oil Co., Ltd.
Engine room stores	Willcox & Co.
Cables, boxes, &c.	Henley's Telegraph Works Co., Ltd.

Leigh.—The Tramways and Electricity Committee have accepted the tender of Messrs. E. Green & Son, Limited, for economiser, for £218.

Newport (Mon.).—Mr. Parshall reported to the Corporation that the tender of the Alpons Custodis Chimney Construction Company, for the erection of the stack at the new power station, which was accepted at the last meeting, did not comply with the specification. He had asked the company to send in a revised tender which was £399 in excess of the first. This contained stipulations which the Electrical Committee have been advised not to accept. It has now been decided that the work shall be executed by Messrs. A. S. Morgan & Co., Limited.

Stockton-on-Tees. — The British Thomson-Houston Company, Limited, of Rugby, have secured an order from the Power Gas Corporation, Limited, for three 110-kw., 220-volt generators for direct coupling to gas engines, at 160 r.p.m., to be used for the electrical operation of the above company's works at Stockton-on-Tees.

Wimbledon.—The Wimbledon Council have renewed their contract with the Electrical Company, Limited, for the supply of meters for the ensuing 12 months. Similar orders have also been received from several other central stations.

Worcester.—The City Council on Tuesday accepted the contract of the British Insulated Wire Company, for 4,850 yards of cable, armoured or lead-covered, with troughing and pitch-filling, laid direct in the ground, at a cost of £1,579. The cables will be paid for out of a loan of £30,450, obtained by the Corporation to provide plant for equipping the new generating station which will supply electricity to the Worcester Tramways Company, who are converting a system of horse traction into electric traction.

Telephone Committee, referred to the strong opposition which had

tramways in the city of Valparaiso.

FORTHCOMING EVENTS.

Friday, April 11th.—At 8 p.m. Electro-Harmonic Society. Smoking Concert (last of the season).

Tuesday, April 15th.—At 7.30 p.m. Institution of Electrical Engineers (Manchester Section). Meeting at Owens College. Paper by G. E. Fletcher on "The Treatment and Use of Air Core Cables."

Wednesday, April 16th.—At 7.30 p.m. Institution of Electrical Engineers (Birmingham Section). Meeting in the Physical Theatre of the University.

Thursday, April 17th.—Institution of Mechanical Engineers. Anniversary Dinner at the Hotel Cecil.

At 8 p.m. Institution of Electrical Engineers (Dublin Section). Meeting at the Royal College of Science. Paper on "Railway Blocks, Telegraphs and Accessories; Recent Practice," by A. T. Kinsey.

Friday April 18th.—At 9.0 p.m. Royal Institution. The Right Hon. Sir H. A. Macdonald, F.R.S., on "The Autocar."

Saturday, April 19th.—At 3.0 p.m. National Association of Electrical Contractors (Northern Section). Meeting at the Exchange Station Hotel, Liverpool.

At 1 30 p.m. National Association of Electrical Contractors (Northern Section). Meeting of the Executive and Delegates of the Local Associations.

Wednesday, April 23rd.—At 8 p.m. Institution of Civil Engineers. Special meeting. Tenth "James Forrest" lecture, by Sir William C. Roberts-Austen, on "Metallurgy in Relation to Engineering."

NOTES.

Isaacson and Wife v. New Grand Theatre.—This case came before the King's Bench Divisional Court on Wednesday on the appeal of plaintiffs from a judgment delivered at the Westminster County Court for the defendants. The case was commented upon in our columns at the time. Their Lordships now sent the case back for a new trial. The Lord Chief Justice did not think there was sufficient evidence to enable the Westminster Judge to hold that the deceased man was not a workman, and that there was no evidence to go to the jury. Our report will appear next week.

Electric Light Signs.—The electric light sign, whatever may be said about it with an eye to its appearance and æsthetic value, appears to have come to stay and be very popular. The use of these signs can be greatly encouraged by central stations which will take up the subject and investigate it with a view to the local conditions. The Chicago Edison Company has added a very large amount of sign lighting to its circuits by the use of standard types of signs which the company makes and rents to its customers complete, the rent including the use of the sign and the current necessary to illuminate it during certain hours. These signs take a large variety of forms, the standard types ranging from those employing five lamps to those using upward of one hundred. Unlike the fan motor, however, the electric sign is not a load which comes at the hours of light consumption, but burns straight through the peak of the evening load, which fact must, of course, be reckoned with in exploiting its use.—New York *Electrical Review*.

American Competition. — Sir Christopher Furness, M.P., delivered a lecture at West Hartlepool last week respecting his recent American tour. Sir Christopher alluded first to the enormous development of the American iron trade, bringing us into such severe competition, and to the American industrial invasion, the severity of which was awakening us to its consequences, slow though we had been to recognise its danger. Englishmen were not made of the stuff to be beaten upon their own ground, being determined that the time had not arrived for the old country to shut up shop; and they must disabuse Americans of the idea that they could capture our markets, and make New York, instead of London, the Clearing House of the world. Personally, he believed in the old country, and in its future. He regarded with serious apprehension the clamour for protection here, believing that free trade had given us our present commercial greatness. In concluding, the lecturer said that no one could fail to be impressed by visiting such a mighty and enterprising nation, with its natural resources and vast territory, its rapid strides in the path of progress, with the energy and acumen of its people, pointing to a development with which England could scarcely hope to compete; but we could compete with them in energy and enterprise. Our natural resources might not equal those of the United States, but let it go forth that we had lands beyond the seas, territories vastly greater than theirs, and not less rich. Our highway was upon the open sea, and if we so developed our Colonies as to hold them to the Fatherland as the compass to the pole, it was his deliberate opinion that neither from America, nor from any other nation, need we fear that the near future would add anything but greatness to our country's glorious past.

Mr. W. Abraham, M.P. (Mabon), who has recently been making investigations into labour matters in America, has delivered an important and interesting statement on the subject at Rhondda. His remarks should be well considered by trades unions and engineering workmen. We are only able to give a brief abstract, and for this we are indebted to the *Times*. At one time, he said, he thought that working with machinery could not be to the advantage of the men he represented. He returned thoroughly cured of the prejudice which he, with others of his class, had entertained, and would in future advocate, wherever possible and necessary, the use of machinery to produce things necessary to maintain Great Britain in competition with other countries. Having explained how 1,200 tons of steel rails were produced every 24 hours in Illinois by machinery without the aid of manual labour, except in directing it, he said that in the past, whenever an excuse was wanted in this country for not adopting the American plan, the prejudice of workmen against machinery was trotted out. The capitalists of America would not put up with the second best of anything, and whenever new plant was invented, they calculated the purchase cost to them and threw away machinery that would have been used in England for 10 or 15 years longer. It was the duty of capitalists in this country to find, first of all, the plant, and then the workers could be taught to regulate machinery, instead of acting like machines themselves, as they had done too long. There was no sentiment in America, where the people believed in the radical principle that there should be no chains of formality to tie a man down to the circumstances of his birth, and every man was invited to ascend, and valued according to his efficiency and the wages which he earned. The governing law of labour there, whether they liked it or not, was the survival of the fittest. There were strong trade unionists in America, and they were allowed to bargain for their fellow men with the capitalists as to the price of work, but no interference was tolerated as to the amount of work to be done. Every workman was as free as the birds in the air to do all he possibly could, and if he did more than an ordinary day's work he was paid a bonus as an inducement. That was the best side. But, on the other hand, when a workman failed, after, perhaps, long years of faithful service, owing to old age or anything else, he was thrust aside and a younger man put in his place.

Modern Works Organisation.—Some further details of the system worked out by Mr. Adrian D. Jones, of the Jandus Arc Lamp Works, which we were unable to include with our article on another page, will be of interest. The essential feature of a limit gauge system for modern work is to ensure that not only is *sufficient* accuracy obtained, but—of almost equal importance from the commercial point of view—that unnecessary accuracy or finish is not given. The limits for a fitting or sliding part may be within ·0005 in., while, for example, an accuracy of ·02 in. is ample for the fitting for a soft asbestos washer. In the Jandus Works every limit gauge is marked with the variation that the gauge allows; the workman therefore knows the degree of finish required, and by the avoidance of unnecessary accuracy the cost has been greatly reduced. Enhanced accuracy is secured at the essential points, and a high degree of finish obtained, as bad surface finish will be shown by limit gauges having an accuracy of within ·001 in. Every jig or special tool is numbered, and a card index in the tool-room gives the numbers of the jigs, gauges, and special tools, and the sizes of drills or taps, &c., required for the completion of any part; these can therefore be at once collected and handed to the workman in exchange for a "tool-room order." This order is a printed form requisitioning "One complete set of tools for part No. ———." The foreman has only to fill in the man's name and the part number, and sign the order, for the workman to obtain every tool required. The tool order is filed until the tools are returned; these are then checked with the card index, and cutting tools reground, the order being cancelled and returned to the workman, thus releasing him from further responsibility for the tools. Similar methods are used to facilitate the distribution of work. The orders for lamps may require delivery in a few hours or as many months. Under the "colour system" the orders are classified as received, and entered on order forms of the correct colour, indicative of the urgency of the order. If for standard patterns, the lamps are in stock, and are at once adjusted, tested, packed and despatched; they are at every stage accompanied by orders, and distinguished by labels of the same distinctive colour. The advantage of colour lies in the fact that several hundreds of lamps and other apparatus are always on order and in course of despatch. Urgently required goods may at once be distinguished amongst large quantities, and special attention given, even the smallest order for a few carbons not being overlooked if required at once. The rule is that all orders are despatched on the day they are required, and the coloured labels and forms enable this to be checked with certainty. All parts are made for stock, and withdrawn when required to be assembled; on the stock falling below the minimum, a coloured order card is made out and sent to the works. By this means the manufacture and delivery of great numbers of lamps are accomplished almost automatically and with the highest degree of certainty that no order, however small, shall be overlooked.

Electricity v. Oil for Train Lighting.—The North British Railway Company, who own the long tunnel from Bellgrove to Finnieston, Glasgow, a distance of about 4 miles, have decided to abandon the use of electricity for the lighting of their railway carriages in the same. The system, in use for about 15 years now, consists of a third rail carrying the current to a wheel collector on each carriage. No doubt wear and tear have accounted for a good deal, but in its present condition the light was more often "out" than "in." The railway company are to be congratulated upon the decision to abandon the present inefficient service, but the same cannot be said if their intention is to go back to the older form of oil lighting, compared with the up-to-date illuminant.

The Bournemouth Appointment. — The following passage, which is referred to in our "Correspondence" columns, is reproduced from the *Bournemouth Visitors' Directory* of 5th inst:—

A New Tramway Appointment.

The Tramways Committee recommended that the consulting engineer and the borough engineer be authorised to engage Mr. Barber as works engineer and traffic manager, at a salary of £250 per annum, subject to his producing to the committee satisfactory testimonials from the Corporation of Blackburn. They also recommended that the consulting engineers and the borough engineer be requested to present a report as to the staff likely to be required in connection with the tramways scheme, with particulars of duties and salaries proposed.

Councillor Hawkes, referring to the first recommendation, asked why the exceptional course had been adopted of not having advertised.

Alderman Lawson said Councillor Hawkes was at the committee meeting, and knew all about it.

Councillor Hawkes admitted he was present, but said other members were not. He moved that the question of the appointment be referred back to committee, with instructions for them to advertise for a works engineer and traffic manager. This would enable them to make a possibly better selection, and, secondly, would do away with jobbery. Councillor Hawkes was proceeding to say that Mr. Barber was once in the office of the consulting engineers and to suggest that the appointment was due to fraternal relationship between the senior partner of that firm and the borough engineer when

The Mayor asked him to keep to the point and not go into personalities.

Councillor Hawkes persisted in his line of speech.

The Mayor: I rule you out of order, going on in that strain.

Councillor Hawkes: I was trying to show, sir, that in this matter we have not the protection we usually have.

The Mayor: Yes, we have heard so.

Councillor Hawkes: I say we have no protection even from the Chairman of the Tramways Committee.

The Mayor: Stick to your point. You are wasting the time of the Council.

Councillor Hawkes: Sir, I want to know who Mr. Barber is. He is a man who has to have a permanent position in this borough, and surely we have a right to know what are his qualifications.

Councillor Trowbridge seconded the amendment.

Councillor Gunning opposed, observing that if they wanted to make the tramway scheme a success, it would be unwise to make an appointment of which the consulting engineers, in whom they had reposed confidence, would disapprove.

Councillor Allen said there was no other Corporation in England that would not advertise such a post. He did not know what was behind the scenes, but for goodness' sake don't let them have any Bournemouth jobbery.

Alderman Lawson denied that there was any jobbery in the matter. The argument in favour of the appointment lay in the statement of Mr. Hawkes himself that Mr. Barber was well known to the consulting engineer. That was a fact. Mr. Barber, after leaving Messrs. Lacey, Clirehugh & Sillar, had gone through the very stages of tramway work at Blackburn that they in Bournemouth were about to go through, and for that reason he was just the man they wanted.

Alderman Lane thought it was a grand thing to get a man who had had special experience elsewhere.

On a division, Councillor Hawkes's amendment was lost, and the report adopted.

More Nonsense.—This time the *People's Friend* has rushed in upon the sacred ground, and perpetrates the following valuable fragment of science:—"Perhaps the greatest of all mysteries to the uninitiated about telegraphy is the fact that when a wire is broken or damaged, say, between Glasgow and Aberdeen, or between England and Ireland, the operator in his room can tell exactly where the accident has occurred. The explanation, however, is very simple. It requires force to send electricity through a wire, just as it does to pump water through a hose. The longer the wire is, the greater is the force required. This force is measured, but instead of calling it pounds, as in measuring the pressure in a boiler, electricians call the unit of electrical force 'ohms.' Suppose a wire between two offices is 150 miles long, and that on a stormy night it gets broken somewhere. The telegraphist knows that when the wire was sound it took just 2,000 ohms to send a current through, or 14 ohms per mile. He now finds that he can send a current with only 700 ohms. He divides 700 by 14, and finds that the break in the wire is 50 miles from his end. When the wire is under the sea a curious thing happens. The electricity decomposes the sea salt, and a new salt is formed on the broken ends of the wire, and until that is cleared away by what is called a zinc current acting for 10 or 12 hours, no measurement can be made." Unfortunately, daily journals that ought to know better have accepted this, and reproduced it quite seriously. We want a technical press censor.

Repayment of Loans.—The House of Commons Select Committee, which was recently appointed "to inquire and report as to the statutory and other conditions limiting the periods for the repayment of loans raised by local authorities, whether any relaxation of such conditions is desirable, and whether uniformity of practice can be secured," sat on Tuesday for the first time to take evidence. Mr. Kershaw, one of the assistant secretaries to the Local Government Board, was the first witness, and the Committee adjourned until to-day.

Personal.—The 1901 Exhibition of Glasgow is now almost a thing of the past, but it was brought back vividly to memory on Tuesday, April 1st, by the presentation from the electrical and allied manufacturers and contractors of a gold watch and illuminated address to Mr. J. C. A. Ward, who so ably superintended the electrical installation at the Exhibition. The presentation was made after a very successful dinner, which was held in Edinburgh. Mr. W. A. Chamen occupied the chair, whilst Mr. Pickstone, of Messrs. D. Bruce Peebles & Co., made the presentation on behalf of the contractors.

Mr. James Swinburne has entered into partnership with Mr. W. R. Cooper and Mr. G. H. Baillie, who, in future, will be associated with him in his practice as consulting engineer.

Mr. Hooley, Controller of Postal Stores, who succeeded Mr. C. E. Stuart as Controller of Telegraph Stores, will henceforth have charge of the combined departments. The *Standard* says that Sir George Murray, Secretary to the Post Office, is introducing many administrative reforms within the department. His aim is to reduce the number of small sections, and as far as possible to minimise the number of scales of pay with which the postal estimates are encumbered. The amalgamation of the two stores departments has abolished a controllership worth £900 per annum, while raising the maximum of another post by £200. It is understood that the telegraph factories at Mount Pleasant and Holloway will be placed under the recently appointed engineer-in-chief, Mr. John Gavey.

Among the list of new members elected at the Royal Institution on Monday, we observe the name of Mr. W. E. L. Gaine.

Mr. J. C. Evans, of the Eastern Telegraph Company's staff, was lately the chief guest at a pleasant gathering of his friends in Cape Town on the occasion of his departure therefrom on leave of absence to visit his native country. Mr. Tom Howard presided, and in the course of the evening presented Mr. Evans with a handsomely-fitted travelling bag, which had been subscribed for by his friends. Lieut. Arnold Gray, on behalf of the Cambrian Society, of Johannesburg, wished Mr. Evans *bon voyage*.

Mr. D. Ellison, assistant surveyor under the West Bromwich Corporation, has been appointed assistant engineer to carry out the duties of clerk of works during the reconstruction and electrical equipment of the tramways in the borough, the salary being £200 per annum.

Mr. Henry Bland, of the firm of Bland Bros., electrical engineers, of Newcastle-on-Tyne, President of the Northern Section of the National Electrical Contractors' Association, and a vice-president of the National Association, has just returned to business after undergoing a successful operation for an internal complaint, at St. Peter's Hospital, London.

It is reported from New York that the various scientific organisations of America have arranged to pay to Lord Kelvin one of the greatest tributes of its kind ever accorded there to a man of science. Columbia University, the American Institute of Electrical Engineers, the National Academy of Sciences, and all the leading physical societies, have combined to organise the reception to Lord Kelvin on his arrival at New York on April 21st.

Birkenhead Tenders.—At the monthly meeting of the Birkenhead Town Council, Mr. J. Edwards asked the chairman of the Electric Lighting Committee if he could give him any idea of the total cost of the tenders which had been accepted by the committee, the amounts of which were not stated in the minutes. Mr. J. H. McGaul said that he could give the amount to Mr. Edwards privately, but that there were requests in the tenders that the amounts should not be made public. That was why the Electricity Committee and other committees did not publish the prices given in the tenders.

Navy Boilers.—A "Special" to the *Pall Mall Gazette* says that "letters from the Mediterranean announce that several of the Belleville boilered ships in our fleet there have given a great deal of trouble, and it is rumoured that the battleship *Canopus*, which shortly completes her maiden commission, will be sent home to undergo extensive boiler repairs. Another instance of the short life of the Belleville is furnished by the cruiser *Arrogant*, which, in consequence of the trouble given by her boilers, is to be removed from the Channel Squadron. It is not unlikely that her Bellevilles will be removed."

Niagara Falls.—On the afternoon of Monday, March 24th, ground was broken for a new power development on the Canadian side at Niagara Falls. The development contemplated is that provided for by the franchise of the Ontario Power Company, and the first sod was turned in Victoria Park, close by the Horseshoe Fall. Under this company's plan of development water will be taken from the Welland River from a point in the village of Chippewa, and conveyed through an open canal and conduits to the high bank near Table Rock House, from which point conduits will carry it to a power house to be erected in the gorge at the foot of the Horseshoe Fall. It is stated by the company that the initial development will be 125,000 H.P. Under the present plans the first section of the power station will have an output capacity of 62,500 H.P. It is the company's hope to have power ready for consumers in 15 months, but it will require a vast amount of hard work to accomplish this. The understanding is that the company had to pay a large sum of money to the Commissioners of Victoria Park before they were allowed to break ground, the Commissioners not desiring to treat the Ontario Power Company otherwise than the Canadian Niagara Power Company, whose mammoth development is now well under way.

remarks should be well considered by trades unions and engineering

oil lighting, compared with the up-to-date illuminant.

Nernst Street Lamps in America.—We understand from the *Electrical World* of New York that the Union Electric Light and Power Company, whose plant is located in the town of Farmington, Conn., is probably the first in the United States to adopt Nernst lamps exclusively for street lighting. Unionville, the headquarters of this company, is a village in the town of Farmington, near the Farmington River, and about 10 miles from the main business section of Hartford. A few months ago the Union Electric Light and Power Company began the operation of an entirely new plant, and provided an extended system of public lighting with Nernst lamps. "All energy is distributed from the station at the constant pressure of about 2,400 volts, and is subsequently transformed to 224 or 112 volts constant pressure for street lighting and commercial service. For house lighting the 112-volt pressure is mostly used, but on business premises and for street lamps 224-volt lines are employed. Both street and commercial lighting are done from the same transformers and circuits, but an independent return is provided for street lamps, so that they may be shut off independently of the commercial service. These independent return wires for the street lamps make it also possible to shut off all of those lamps connected to each transformer at a single point, instead of going to each individual lamp. Nernst lamps to the number of 134 are now in use on this system for street lighting in the village and borough above named. Of these lamps, 120 have one glower each, and each consumes approximately 88 watts at 224 volts. The remaining 14 lamps are of the six-glower type, and each requires about 528 watts at 224 volts. These street lamps are supplied from 12 transformers, located at different points about the town, and are connected to the same circuits that are used for commercial service. The greatest length of any 224-volt circuit supplying street lamps is a little less than one-half mile from its transformer. Evidently this plant at Unionville is in a position to test the practical value of Nernst lamps for street lighting on a considerable scale, and the results of its experience should be of especial interest to managers of central stations."

Glasgow Technical College.—One of the late Mr. Dick's, of gutta-percha fame, benefactions was to leave £25,000 to the building fund of the new College.

Electric Motor Vehicle Trials.—The trials of electric motor vehicles, organised under the auspices of the Automobile Club, are to be held in July next.

Institution of Electrical Engineers (Manchester Section).—A meeting was held at Owens College last Tuesday, and a paper read by Mr. A. R. Bellamy on "Large Gas Engines for Driving Electric Generators."

Appointments Vacant.—A mechanical engineer is wanted for the Pinkston power station at Glasgow at £250. See "Official Notices."

London Underground Railways.—The *Times* of yesterday has an article announcing the formation of the Underground Electric Railways Company of London, with £5,000,000 capital, to electrify the District Railway and build and work four other underground lines.

The Pacific Cable.—It is reported in the Press that the Pacific cable has now reached Fiji.

THE CENTRAL STATION ENGINEER.

On Wednesday, April 2nd, the staff of the Croydon electricity works, gave a valedictory dinner to Mr. T. H. Minshall, on the occasion of his resigning the appointment of borough electrical engineer. Mr. W. Jensen, the deputy borough electrical engineer, was chairman; there were also three members of the Electricity Committee present as visitors, and in spite of the solemnity of the function a pleasant evening was spent, a musical programme being provided by the members of the staff.

Mr. John Roberts, borough electrical engineer at Durban, was married at Johannesburg, on March 27th, to Kate Dagmar, youngest daughter of Mr. H. C. Bunkell, of Barnes, Surrey.

The Middlesbrough Electric Lighting Committee last week appointed Mr. H. M. Taylor, of the British Westinghouse Company, London, electrical engineer to the Corporation, at £250 per annum.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Improved Electric Glow Lamp Company, Limited.—Particulars of registered mortgages and charges. Date of debenture, July 18th, 1901. Amount secured, £4,000. Property charged:—The undertaking and property of the company, present and future, including uncalled capital. Trustees, F. W. Nash and F. J. Hughes.

(Note.—Former mortgage debenture for £4,000 (dated March 7th, 1901,) satisfied in full on July 16th, 1901.)

Southport Tramways Company, Limited.—Particulars of registered mortgages and charges. Date of creation, March 12th, 1902. Total amount secured, £5,000. Property charged:—The company's undertaking and property, present and future, including uncalled capital. Trustees, J. Hesketh and S. B. Murray. Date of registration, March 15th, 1902.

SUPPLY STATION ACCOUNTS.

Liverpool Corporation Electricity Accounts.

The growth of the Liverpool undertaking is phenomenal, and we are not surprised to be told that it is intended to seek for further generating works sites outside the city, from which the transmission will probably be high pressure alternating with converting stations. The development is indicated by the following figures:—

Year.	From private supply.	From public lighting.	From traction.	Manufacturing account. Sales and repairs.	Manufacturing account. Wages and material.	Profit.
1898	£50,809	£2,631	£437	£21,818	£18,954	£2,864
1899	£59,713	£1,925	£7,362	£19,501	£17,432	£2,069
1900	£72,056	£1,764	£30,597	£23,219	£20,674	£2,545
1901	£91,311	£1,907	£68,913	£23,962	£20,621	£3,341

The position at the end of last year is shown by the next statement.

General Statement.

	1900.	1901.	Inc.
Total capital expenditure ...	£1,048,559	**£1,187,622**	£139,063
Number of units sold	11,564,335	**20,018,142**	8,453,807
No. of lamps connected	298,990	**359,518**	60,528
Maximum load in kw.	6,352	**9,431**	3,079
Gross revenue	£109,770	**£170,785**	£61,015
Gross expenditure...	£60,292	**£85,104**	£24,812
Gross profit	£49,478	**£85,681**	£36,203
Average price per unit sold ...	2·166d.	**1·943d.**	−·223d.

The units sold aggregated 20,018,142, of which 6,006,685 were sold to private consumers, 228,949 to public lamps, and 13,782,508 for traction. The public lamps numbered 156, equivalent to 1,231 16-c.p. The plant installed amounted to 19,610 kw. The prices charged were, for private lighting, 4d.; for public lighting, 2d.; for power, 2d. and 1½d.; and for traction, 1·2d. per unit. With an average of just over 2d. per unit sold, the revenue reached nearly £171,000, and yielded a gross profit of over £85,000. Liverpool is, and has been for some years, one of the most important undertakings in the country, and these figures support its claim to be one of the most efficiently managed.

Revenue Statement.

	1900. Gross	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
	£		£		
Sale of energy	104,373	2·166d.	**162,049**	1·943d.	−·223d.
Meter rents	2,029	·042d.	**2,439**	·029d.	−·013d.
Sale of fittings, &c., profits on manufacturing account	2,545	·053d.	**3,341**	·040d.	−·013d.
Sundry receipts, rents, &c. ..	823	·017d.	**2,956**	·035d.	+·018d.
Gross revenue ...	£109,770	2·278d.	**£170,785**	2·047d.	−·231d.

The costs show reductions in each item. The works costs have been brought down by nearly ·15d., and the total cost by almost ¼d., and the latter now stand at just over 1d. per unit, of which coal represents very nearly half. In this item the most marked change appears, as the figure has been reduced by one-sixth. It will be interesting to see what further economies Mr. A. Bromley Holmes, the city electrical engineer, will be able to effect.

Cost of Production.

	1900. Gross.	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Coal (and unloading same)	£28,944	·601d.	£41,600	**·499d.**	−·102d.
Oil, waste, water, and engine room stores.	3,172	·066d.	5,295	**·064d.**	−·002d.
Salaries and wages incurred in generation and distribution.	9,173	·190d.	14,635	**·175d.**	−·015d.
Repairs and maintenance of engine, boilers, dynamos, buildings, &c.	4,704	·098d.	5,865	**·070d.**	−·028d.
Works costs ...	£45,993	·955d.	£67,395	**·808d.**	−·147d.
Rent, rates and taxes ..	6,707	·139d.	7,258	**·087d.**	−·052d.
Management expenses, salaries of managing engineer, secretary, clerks, &c., management of Corporation stock, and auditor's fees.	5,836	·121d.	8,756	**·105d.**	−·016d.
General establishment charges, stationery and printing, law charges and insurance.	1,296	·027d.	1,439	**·017d.**	−·010d.
Other expenses: Repairs of property, certification of meters, and stamp duty.	460	·009d.	256	**·003d.**	−·006d.
Total costs ...	£60,292	1·251d.	£85,104	**1·020d.**	−·231d.

Local Government Board, was the first witness, and the Committee adjourned until to-day.

well under way.

The gross profit amounted last year to £85,681. Of this sum, £61,595 was required for financial charges, leaving £24,086 as net profit. This was allocated to the local rate and the renewal fund, with a contribution to a reserve fund.

PROFIT STATEMENT.

	1900.	1901.
Interest on loans	£26,148	£37,195
Sinking fund for repayments	17,833	24,400
Net profit carried to City fund	2,000	7,583
,, ,, renewal fund	3,497	6,503
,, ,, reserve fund	—	10,000
Gross profit	£49,478	£85,681

CITY NOTES.

South London Electric Supply Corporation.

The ordinary general meeting of the shareholders of this corporation was held on Tuesday at the offices, Bengeworth Road, Loughborough Junction, S.E., Mr. George Ellis, J.P., presiding.

The CHAIRMAN, in moving the adoption of the report, said he was glad to be able to state that the progress and prospects of the company to-day were quite as satisfactory as he anticipated they would be when they met last year. During 1901 they increased the number of lamps on circuit by 30 per cent., and further applications were coming in slowly but steadily. Of course, the directors would have been glad if the shareholders could have received a dividend upon their investment. That could not be done that year, but the directors trusted that it would be the case before long. It must be remembered that up to the end of the account which was now presented, the station had only been at work for about two years, and so far as he knew, there was no precedent of an electric lighting company paying a dividend within two years of its getting to work. Even the companies which stood as the most successful ones to-day, paying the highest dividends, and quoted at the highest prices, had to go through an unproductive period of considerably longer than that. But he was glad to say they had commenced making a profit on their working. As would be seen from the accounts, there was a credit balance of £1,691, as against a debit balance of £889 14s. last year, showing an improved result to the extent of £2,733 13s. The increase over the previous year would have appeared even greater if in that year they had not had the London Electric Supply Company as what one might term an abnormal customer, paying them £3,719 for current which they had had to buy from them while their own station was being reconstructed. This year the company was working at greatly less cost for coal with a much larger number of customers, owing to the saving consequent upon the economising and condensing plant which only got to work at the end of last year. They would be glad to know that while for the first 11 weeks of last year the coal bill was £2,149, this year for the same period it was only £1,132, or very little more than half. The company's appeal against the assessment of the works had been very successful, a reduction of 45 per cent. being obtained. They had had, however, to engage expert assistance at a cost of £262 10s. Law expenses, which might appear high, he should explain had been almost wholly made up of fines paid for smoke summonses and advocates' fees on the hearing of them. The persecution they were subjected to in that matter was so serious that they took a test case to the Divisional Court, in respect of a fine imposed by the magistrate for black smoke alleged to have come from the chimney at a particular time when the board was meeting in that room. They were watching the chimney at the hour named in the summons, and knew that there was no black smoke. But the magistrate would not believe them, and fined the company on the evidence of men paid by the Borough Council to watch the works and get a conviction, and the Lord Chief Justice said the magistrate's finding was conclusive. He was glad to say, however, that the fight they made seemed to have caused the Borough Council to be chary about issuing further summonses. At the foot of the revenue account was an item which apparently needed some explanation. When the dust destructor was shut down after the magistrate's decision, certain plant on order for use in it became unnecessary, and they considered themselves fortunate in arranging to cancel the contract for a cash payment of about £150. It seemed to them that the item would be properly chargeable to the capital account, but their auditors thought otherwise, and therefore it was debited to revenue. In estimating the results already achieved, it must continually be borne in mind that the undertaking so far had been heavily handicapped by the provision of a generating station very much in excess of present requirements; but not only would they reap the advantage of that in the future, when they would be able to satisfy the demands of a greatly increased number of customers without further capital outlay, but they were going to see the benefit of it at once, as if they had not had that large station and plant they could not have taken up the very satisfactory contract they had recently arranged with the L.C.C. By that they were to supply for a period the power for working the machinery erected by the L.C.C. on their land to drive the electric tramways, now in course of construction in South London. They had made it an essential feature of their negotiations with the L.C.C. that under no circumstances would they incur any capital expense at all in meeting their demands. The whole of that, therefore, was thrown upon them, and all the company had to do was to supply the steam power from their existing station, and they expected that all the steam-power they could possibly spare from their lighting business would thus be profitably utilised for some years to come. In the absence of accurate data, it would be undesirable for him to name any probable figure as to the profit they were likely to make from the contract, but they might take it that the profit would be considerable, and he thought it would be larger than any of them would suppose. The further advantage of that arrangement would be that it would yield them a good income while they were doing their best to build up the ordinary business of the company; so that when that source of profit ceased they should have a large and sound lighting business to fall back upon. A subject which engaged the attention of the board at every meeting was the best means for increasing the number of customers and the number of lamps. All kinds of methods for that purpose had been tried, by means of advertising, canvassers, &c., but none of them had resulted in increasing the number of lamps by more than about 1,200 per month, which appeared to be about the normal rate of increase expected. In that district they had, of course, to contend with very serious competition, the South Metropolitan Gas Company, which supplied good gas at a lower rate than any other in the metropolis, and although they were quite sure that customers who changed from gas to the electric light would be satisfied with the result, it was difficult to convince them of that in advance, or to get them to look at anything else but the actual difference in cost. No effort of the board would be spared in increasing the number of lamps connected. The committee of shareholders appointed by special meeting held last year, for considering the proposed addition to their area of supply, were good enough also to consider the general position of the company, and to confer with them thereon. Several suggestions were made, one being for the provision of a day-load plant, so as to save running the large engines in the daytime. That would doubtless save some coal at present, but he thought they would soon outgrow the possibilities of that day-load plant, and then the capital sunk in it would be practically lost. It was also suggested that they might in the summer months buy their current from a neighbouring company, and so avoid running their station at a loss, which it was inevitable they must do during the summer, but that would involve discharging their men and staff, and they would not have any control over the supply, and yet would be fully responsible for the consequences of any breakdown or inefficiency. As regarded the proposed addition to the area of supply, the committee of shareholders were of opinion that it was not desirable to take that up. The hostility which the local authorities had shown to the corporation from its outset had been a great obstacle in the way of the company's progress, and they had done their best to remove it. Before concluding, he would like to call their attention to a report he had received from the engineer, dealing with the quarter of the year which had just passed, January 1st to March 31st last, which gave the units and costs for the three months. In 1901 they generated 387,926 units, while this year, for the same period, they generated 423,238 units, or an increase of 35,000. Dealing with the costs, salaries for 1901 were £146, against £135 this year, wages £341, as against £318, the cost of coal was £2,434, against £1,464—not much more than half—stores £386 last year, against £159 this year; water £63, against £32, and repairs £240, as against £168, making a saving on the three months, as compared with last year, of £1,333.

Captain E. J. BAX seconded the motion, and the report was adopted.

Considerable discussion ensued as to the election of a director to take the place of Mr. W. W. Phipps, who, although eligible, stated that he did not seek re-election, but wished to retire in favour of Mr. Atherton.

On the motion for the election of Mr. Atherton being put to the vote, the resolution was defeated, and accordingly a poll was demanded on behalf of that gentleman, which will take place next Tuesday.

This terminated the proceedings.

Babcock & Wilcox Company.

THE report for the year 1901, to be submitted at the general meeting on April 15th, states that the net profit, after deducting depreciation on plant, &c., amounts to £157,267. To this has to be added the balance brought forward from last account of £15,679, making a total of £172,946. After deducting the interim dividends paid October 1st last on the ordinary shares at the rate of 6 per cent., and on the preference shares, amounting to £34,800, there remains a net balance of £138,146. From this the directors recommend the payment of a dividend at the rate of 9 per cent. on the ordinary shares for the December half-year; placing to the reserve fund £45,000, and to the dividend equalisation fund £25,000, leaving a balance to be carried forward of £17,446.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to the Electric Lighting and Traction Company of Australia, Limited, £75,000 5 per cent. debenture stock; and a further issue of 10,000 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 20,001 to 30,000. The Committee has appointed special settling day as under:—Wednesday, April 16th, City of London Electric Lighting Company, Limited, further issue

registered mortgages and charges. Date of creation, March 12th, 1902. Total amount secured, £5,000. Property charged:—The company's undertaking and property, present and future, including uncalled capital. Trustees, J. Hesketh and S. B. Murray. Date of registration, March 15th, 1902.

meters, and stamp duty.)		460	0·09d.	256	0·05d. — 0·04d.
Total costs	...	£60,292	1·251d.	£85,104	1·020d. — 231d.

of £100,000 4½ per cent. second debenture stock (redeemable); Westminster Electric Supply Corporation, Limited, 28,141 5 per cent. cumulative preference shares of £5 each, £2 10s. paid, Nos. 110,101 to 138,241, and has ordered same to be quoted officially.

Marconi's Wireless Telegraph Company. — The *Times* says that a statement has been issued to the effect that a contract has been signed by this company for the sale of its United States rights and patents to an American company with a capital of 6,150,000 dollars. The parent company receives for its rights and patents £50,000 in cash, and shares in the American company which represent a controlling interest. The English company also receives a further sum in cash for its stations already erected in the United States. The Canadian Government has executed a contract under which it undertakes (*inter alia*) to pay a subsidy of £16,000 for the erection of a Marconi station on the coast of Canada for the transmission of wireless telegraph messages to England. The station will be worked by the Marconi Company, which will also receive all the receipts from messages.

Anglo-American Telegraph Company.—The directors have resolved, after placing £6,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending March 31st, 1902, of 12s. 6d. per cent. on the ordinary stock, and £1 5s. per cent. on the preferred stock, less income-tax.

Oriental Telephone and Electric Company.—The directors recommend, subject to final audit, a further dividend of 3½ per cent., free of income-tax, making, with the interim dividend paid on October 31st last, a total of 6 per cent. for the year ended December 31st, 1901.

TRAFFIC RECEIPTS.

Blackburn Corporation Tramways.—The receipts for the week ending April 4th were £987; corresponding week last year, £702; increase, £285. Total to date, £8,708; corresponding period last year, £6,943; increase, £1,765. Miles of track open, 10¾.

Blackpool and Fleetwood Tramways.—The receipts for the week ending April 5th were £718; corresponding week last year, £384; increase, £334. Total receipts to date, £3,069; corresponding period last year, £2,268; increase, £801.

Bristol Tramways and Carriage Company.—The receipts for the week ending April 4th were £5,467; corresponding period last year £4,027; increase, £1,440.

Central London Railway.—The receipts for the week ending April 5th were £6,635; corresponding week last year, £5,654; increase, £981. Total receipts to date, £92,475; corresponding period last year, £84,889; increase, £7,586. Miles open, 6.

City and South London Railway.—The receipts for the week ending April 6th were £2,862; corresponding week last year, £1,800; increase, £1,062. Total receipts to date (14 weeks), £41,802; corresponding period last year, £28,237; increase, £13,565. Miles open, 6½; last year, 4½.

British Electric Traction Company.—The following returns are issued of the undertakings of this company for the week ending March 28th:—

Company.	Amount £	Comparison with corresponding week of last year. + £	Comparison with corresponding week of last year. — £	No. of weeks.	Aggregate. Amount. £	Aggregate. Inc. or Dec. + £	Aggregate. Inc. or Dec. — £
Devonport†	388	—	—	12¼	4,796	—	—
Dudley–Stourbridge	671	166	—	12½	7,631	1,481	—
Gateshead†	684	—	—	12½	7,751	—	—
Greenock-Pt. Glasgow	391	241	—	12½	4,525	2,444	—
Hartlepool	229	57	—	12½	2,133	31	—
Kidderminster	103	14	—	12½	1,123	115	—
Merthyr†	220	—	—	12½	2,341	—	—
Middleton†	120	—	—	2 days	120	—	—
Oldham–Ashton	526	66	—	12¼	5,647	42	—
Poole†	288	—	—	12½	2,280	—	—
Potteries	1,450	142	—	12½	16,709	653	—
Southport	198	104	—	12½	1,624	352	—
South Staffordshire†	718	69	—	12½	8,733	518	—
Swansea	473	121	—	12½	4,963	491	—
Taunton*	63	—	—	12½	645	—	—
Tynemouth‡	230	74	—	12½	2,269	84	—
Wolverhampton Dist.	141	94	—	12½	1,524	966	—

* Not in operation last year. † Partly steam.
‡ Comparison from March 18th only.

Dover Corporation Tramways. — The receipts for the week ending April 5th were £249 13s. 10d.; corresponding week last year, £221 7s. 2d.; increase, £28 6s. 8d. Total to date, £2,435 14s. 10½d.; corresponding period last year, £2,219 12s. 2½d.; increase, £216 2s. 8d. Miles of track open, 3. Car miles run, 1902, 5,283; 1901, 5,114. Number of cars, 1902, 13; 1901, 11.

Dublin United Tramways Company.—The receipts for the week ending April 4th were as follows:—D.U.T. Co., £2,815 5s. 7d.; D.S.D. Co. £942 5s. 9d.; total, £4,757 11s. 4d.; corresponding week last year—D.U.T. Co., £3,205 16s. 3d.; D.S.D. Co., £714 12s. 6d.; total, £3,920 8s. 9d.; increase, £837 2s. 7d.; aggregate to date, £54,639 18s. 1d.: last year, £50,852 12s. 0d.; increase, £3,787 6s. 1d. Mileage worked 46. (Easter week, 1902.)

Glasgow Tramways.—For week ending April 5th, 1902, £11,532 11s. 2d., compared with £8,547 0s. 11d. for the corresponding week last year. Aggregate since June 1st, 1901, £519,574 16s. 9d., compared with £401,912 7s. 8d. for same period in previous financial year.

Liverpool Overhead Railway. — The receipts for the week ending April 6th were £1,620; corresponding week last year, £1,607; increase, £13. Total to date £19,489; corresponding period last year, £20,813; decrease, £1,324. Miles open, 6 miles 57 chains.

STOCKS AND SHARES.

Wednesday Evening.

EVERYONE is on the tiptoe of expectation, awaiting the Budget. When it appears, the course of markets may be materially altered, although its broader details have been long guessed. With the shape that the new borrowing may take the electrical markets are chiefly concerned, since their eyes wait upon Consols, and if anything in the Stock Exchange be affected, it will be the Funds. And so, as we write, the markets mark time in stolid anticipation. Changes in price are few, and what there are do not amount to anything particular. The principal rise is one of 10s. in British Electric Traction shares, and the heaviest fall is one of 2 per cent. in Anglo-American Telegraph Preferred stock.

In the electricity supply market dulness is apparent in the shares of the metropolitan undertakings. Citys, Countys, and Metropolitan Electrics are all easier, although the only quotable changes are declines of ½ in the two last-named. We asked in the market if the London County Council's Bill were the reason for the weakness, but the jobbers didn't seem to know. On the other hand, South Londons have advanced 5s. on some knowing buying, and without being allowed to state the reason for the faith that is in us, we may strongly advise holders not to be tempted to part with their shares yet awhile. The proprietors, as lawyers' advertisements have it, may hear something to their advantage before long, unless the present negotiations fall through. Despite the quietude of the share market, the demand for Debentures continues unabated, and the silver-edged securities are now being sought, gilt-edged Electrics being at famine prices. Blackheath and Greenwich 4½ per cent. Debenture certificates have improved to 102, thus recovering the recently-deducted dividend, while City of London Second Debentures are up 1 per cent.

Somewhat similar investment inquiries have helped to advance Central London Ordinary stock this week, the line maintaining its excellent traffics despite the weekly stoppages on the "Tube." This stock has the first claim to a rise in value, but it may not be amiss to reiterate our suggestions as to the cheapness of the Preferred Ordinary. Waterloo and City Ordinary is a point easier in sympathy with the depression in London and South-Western Railway stocks. London and Brighton "A" is a dull market, and some pretend to fear what the rumoured "mono-rail" will be able to do in the way of competition. Metropolitan District has been clique-supported, and is up to 32½, but Metropolitan Consolidated at 73 is rather easier on the week.

British Electric Traction Ordinary shares have come into favour, and, as already noted, mark a rise of 10s., the buying being induced by the fall that has lately taken place in the quotation. London United Tramway issues are the turn off, and we understand that the special settlement in the new Preference shares and Debenture stock will probably be fixed for the end of next week. Barcelona Trams are 8, Calcutta 13½, and Cape Electrics 2¼. Anglo-Argentine are easier at 4 on the disappointing character of the report; the 6 per cent. Debenture stock is steady at 125½. New General Traction Ordinary are 3, and the Preference 4½. Westinghouse Ordinary are changing hands between 6 and 6½, and at 5⅞ the Preference are about a sixteenth lower. Business was done at 12⅛ in Dublin United early in the week, and at 3 in Brisbane Electric Tramways Investment Ordinary shares.

Anglo-American Telegraph descriptions are distinctly flat upon the declaration of a quarterly dividend upon the Preferred stock at the rate of only 5 per cent. per annum instead of the 6 to which the stock is entitled. The poor result is due, no doubt, to the stagnation which has prevailed in Yankees during the past three months, and coming on top of news anent a Canadian subsidy to Signor Marconi, it nearly demoralised the market. Of course, it does not necessarily follow that because the full interest is not paid for the first quarter of the year that it will not be made up in the coming months; the whole matter virtually hinges upon what will be done in American Rails during the period. Eastern Telegraph 3½ per cent. Preference, in receding a point, challenges attention as a sound investment, yielding at the present price exactly 4 per cent. on the money spent. West African Telegraph £10 shares, fully paid, are 2 middle. The last dividend paid on them was in June, 1896, when 6s. per share went to the proprietors. With the cheery news from the Wassan mine this week, the Jungle market may take a turn for the better, and West African Telegraph shares at £2 are a better gamble than most of the mining shares hailing from the Gold Coast. Marconis are about 3 3/16.

Brush Electrical Preference are receiving renewed support, on what grounds it is difficult to see in face of the report. The market, too, tells of buyers of the Ordinary at about 15s., British Insulated Wire are down ½ to 10, and Telegraph Constructions have lost £1. The miscellaneous market, as a whole, is disposed to be somewhat easier, but there are buyers at 5⅞ of Callender's Preference.

struction in South London. They had made it an essential feature of their negotiations with the L.C.C. that under

appointed special settling day as under:—Wednesday, April 16th, City of London Electric Lighting Company, Limited, further issue

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotations April 2nd.	Closing Quotation April 9th.	Business done during week ended April 9th, 1902. Highest.	Lowest.
82,300	African Direct Telegraph, 4 % Debs.	100	...	...	...	99 —103	99 —103	...	...
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	...	...	...	3½— 4½	3½— 4½	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	70 — 80	70 — 80	...	...
804,720	Anglo-American Telegraph	Stock	73/6	3½%	61s.	46 — 49	45 — 48	...	...
3,097,640	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	90 — 92	89 — 91	91⅜	89⅜
3,097,640	Do. do. Deferred	Stock	£1 7s.	5s. %	2s.	7½— 7⅝	6½— 7	7	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	5 %	...	3½— 4	3½— 4	...	...
13,333,300$	Commercial Cable	$100	8 %	...	...	150 —160 xd	150 —160 xd	...	...
1,741,029£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	94 — 96 xd	94 — 96 xd	95	94
16,000	Cuba Telegraph	10	7 %	...	...	4½— 5½	4½— 5½	...	...
6,000	Do. 10 % Pref.	10	...	...	...	13 — 14	13 — 14	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	3 — 4 xd	3 — 4	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	8½— 9½	8½— 9½	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	98 —102	98 —102 %	...	...
60,710£	Direct United States Cable	20	3½%	3¼%	...	9½— 10¼xd	9½— 10½	9 15/16	...
101,300£	Direct West India Cable, 4½ % Reg. Deb., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	...	125 —135	125 —135	131½	127
1,930,807	Do. 3½ % Pref. Stock	100	...	...	...	85 — 88	84 — 87	86	84¼
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	105 —109	105 —109	107	105¼
300,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	...	12½— 13½	12½— 13½	13 5/16	12 9/16
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	108 —113	108 —113	...	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	5¼%	...	...	99 —102	98 —101	98	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103	100 —103 %	102¼	...
180,227	Globe Telegraph and Trust	10	5½%	5½%	...	8½— 9½	8½— 9½	9⅛	8½
180,042	Do. do. 6 % Pref.	10	...	...	...	12½— 13½	12½— 13½	13¼	13
150,000	Great Northern Telegraph, of Copenhagen	10	...	15 %	...	27 — 29	27 — 29	27½	...
75,000	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	93 —103	99 —103	100	...
17,000	Indo-European Telegraph	25	10 %	10 %	...	35 — 39	35 — 39	36	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	...	...	...	100 —104	100 —104	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	2½%	...	...	½— ⅝	½— ⅝	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	5 %	...	...	¾— 1	¾— 1	...	
983,333	National Telephone, Pref. Stock	100	5 %	5 %	5 %	95 — 99	95 — 99	98	95
200,000	Do Pref. shares	2	...	3⅛	3⅜	⅜— ⅜	3⅛— 3⅜	3 3/16	...
1,966,667	Do Def. Stock	100	...	60	64 xd	60 — 64	60 — 64	59	...
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 15	13 — 15	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4⅞— 5⅛xd	4⅞— 5⅛	...	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	93 — 96	93 — 96	94⅜	...
500,000£	Do. 4 % Deb. Stock Red.	100	...	4 %	4 %	101 —105	101 —105	101½	...
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	6 %	...	⅞— 1	⅞— 1	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	99 —102	99 —102	...	...
11,839	Reuter's	8	5 %	5 %	...	6½— 7⅛	6½— 7½	7	...
3,303	Submarine Cables Trust	Cert.	...	...	...	119 —125	115 —125	...	...
58,000	United River Plate Telephone	5	7 %	...	...	4⅜— 5¼	4⅜— 5¼	...	...
40,006	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4½— 5	4½— 5	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	102 —105	102 —105	...	...
155,600	West African Telegraph, 5 % Debs....	100	...	...	...	99 —101	99 —101	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛— ⅜	⅛— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	99 —102	99 —102	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	12 — 13 xd	12 — 13	12⅝	12¼
75,000£	Do. do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	102 —105	102 —105	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	99 —102	99 —102	...	...
88,321	West India and Panama Telegraph	10	8%	...	...	½— ¾	½— ¾	½	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	5 — 5½	5 — 5½	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	3½— 4½	3½— 4½	3⅜	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,600	100	...	...	...	100 —103	100 —103	...	...

ELECTRICITY SUPPLY COMPANIES.

100,000	Blackheath and Greenwich Dist. Electric Light, Ord. ...	1	...	...	...	⅜— ⅝	⅜— ⅝	...	...
100,000	Do. 4½ % 1st Deb. Stock, Prov. Certs.	100	...	...	...	98 —103 xd	100 —104	...	...
19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	8 %	8¾— 9¼	8¾— 9¼	9¼	...
20,000	Do. do. 7 % Cum. Pref....	5	...	...	..	8¾— 9¼	8¾— 9¼	8⅝	...
50,000	Charing Cross and Strand Electricity Supply	5	9 %	9 %	10 %	9 — 10	9 — 10	9 7/16	9 3/16
50,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5¼— 5⅝	5¼— 5⅝	5⅝	...
250,000	Do. do. do. 4% Deb. Stock Red.	100	...	...	...	105 —107	105 —107	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	5½%	4 %	3¼— 3⅜	5¼— 5⅜	...	...
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	110 —113	110 —113	...	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	4 %	0 %	5 %	8 — 9	8 — 9	8½	8 5/16
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12 — 13	12 — 13	12 5/16	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	123 —128	123 —128	...	...
200,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	...	...	...	102 —105	102 —105	104	103⅜
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	4 %	4 %	4 %	8½— 9¼xd	8 — 9	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	12 — 13 xd	12 — 13	...	...
400,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	...	107 —110	107 —110	109¼	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	7 %	...	6 — 6½	6 — 6½	6 3/16	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	6 — 6½	6 — 6½	6⅛	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	106 —109	106 —109	108½	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	11%	12%	10%	10 — 11	10 — 11	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1½— 2	1½— 2	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	...	...	4 — 5 xd	4 — 5	...	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	95 —100	95 —100	...	...
98,769	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	6¼%	14½— 15½xd	14 — 15	14 1/16	...
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	111 —115	111 —115	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	98 —101	93 —101	98⅜	...
8,652	Notting Hill Electric Lighting	10	7 %	7 %	6 %	14 — 15 xd	14 — 15	15	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14 — 15	14 — 15	...	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8 — 9	8 — 9	8⅞	8⅜
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	98 —101	98 —101	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	1⅜— 2¼	1⅜— 2¼	...	...
50,000£	Do. do. do. 4 % Deb.	100	...	...	...	80 — 90	80 — 90	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2 — 2½	2½— 2⅝	2½	2⅜
109,518	Westminster Electric Supply, Ord.	5	13 %	10½ %	10½%	11 — 12	11 — 12	11½	...

* Subject to Founders Shares.
† Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid.
§ Dividends paid in deferred share warrants, profits being used as capital.
‖ Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation April 2nd.	Closing Quotation April 9th.	Business done week ended April 9th, 1902. Highest.	Lowest.
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	4½ — 5½	4½ — 5½	5½	4⅞
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	88 — 92	88 — 92	...	...
62,074	British Electric Traction	10	8 %	9 %	...	13 — 14	13½ — 14½	14	13 13/16
90,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12¼ — 12⅝	12¼ — 12⅝	12⅝	12½
600,000£	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	126 —129	124 —127	126	125
70,000	British Insulated Wire Ord.	5	20 %	15 %	...	9½ — 10½	9 — 10	...	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5¾ — 6½	5⅝ — 6¼	...	...
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	...	8 %	...	13s. to 15s.	13s. to 15s.	...	...
50,000	¶ " " " 6 % Cum. Pref. ...	£1	...	6 %	...	16/6 to 17/6	16/6 to 17/6	...	...
105,731	Brush Elecl. Enging., Ord., 1 to 105,731	2	5½ %	5 %	Nil	½ — 1	½ — 1	...	...
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	3 %	1 — 1½	1½ — 1⅝	1 7/16	1⅛
125,060£	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	97 —100	97 —100	98⅜	98
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	...	17½ — 18½	17 — 18	...	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½ — 6	5½ — 6	5⅞	...
90,000£	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	111 —115	111 —115	...	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	4 %	101 —104	102 —105	104½	103
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	4 %	103 —106	103 —106	105	104
440,100	Do. do. Def. do.	Stock	...	...	4 %	97 —100	97 —100	99½	...
855,000	City and South London Railway	Stock	1¾ %	1½ %	2 %	65 — 68	65 — 68	66	65½
54,000	Crompton & Co., Nos. 1 to 54,000	3	7½ %	8 %	...	3 — 3½	3 — 3½	...	...
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	100 —105	100 —105 %	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	2½ %	...	⅛ — ⅜	⅛ — ⅜	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	2½ %	...	2 — 3	2 — 3	...	...
344,023£	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	78 — 83	78 — 83	...	...
100,000£	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	82 — 87 xd	82 — 87	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	...	1⅝ — 1⅞	1⅝ — 1⅞	...	...
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390... ...	2	...	...	...	2½ — 3	2½ — 3	...	...
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	97 —101	97 —101	...	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9¾ — 10¼	9¾ — 10¼	10 3/8	10
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	98 — 101xd	98 —101	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	15 %	20 %	20 %	17 — 18	17 — 18	17 1/16	...
35,000	Do. do. do. 4½ % Pref.	5	4½ %	4½ %	...	5½ — 6	5½ — 6	...	...
50,000£	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	111 —115	111 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	21⅜	21⅛
300,000£	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	99 —102 xd	99 —102	100	...
37,500	†Liverpool Overhead Railway, Ord.	10	3¾ %	3¼ %	1½ %	5 3/16 — 5 5/16	5 — 5¼	...	...
10,000	† Do. do. Pref., £10 paid	10	5	...	...	11 — 11½	10½ — 11	...	...
7,500	Parker (Thomas), Limited, Ord., Nos. 1 to 7,500	10	...	...	...	15½—16½	15½ — 16½	...	...
	§Rosling, Appleby & Fynn 6 % Cum. Pref.	£1	...	6 %	...	19/- to 20/-	... — ...	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	17½ %	20 %	35 — 38	34 — 37	35¾	...
150,000£	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	... %	...	...	102 —105	102 —105	...	...
25,000	Telegraph Manufacturing, Ord. Nos. 1 to 25,000	5	12 %	12 %	...	10½ — 11½	10½ — 11½	10 15/16	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5½ — 6 xd	5½ — 6	5 15/16	...
540,000£	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	92 — 95	91 — 94	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 1/16—3/16.
National Electric Free Wiring, 13/16—15/16.
Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14½—15.
Do. do. Pref. (£10 pd.), 10⅜—10⅝
* From Birmingham Share List. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (February 6th, 1902).

MARKET QUOTATIONS, Wednesday, April 9th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a " Nitric	per cwt.	22/-	22/-	..
a " Oxalic	per cwt.	82/-	82/-	..
a " Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	80/-	80/-	..
a Ammonia, Muriate (crystal) ..	per ton	£88 10	£88 10	..
a " " ..	per ton	£80	£80	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£13	£13	..
a Benzole (90 %)	per gal.	7/-	7/-	..
a " (50/90%)..	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£20	£20	..
a Lead, Nitrate	per ton	£24	£24	..
a " White Sugar	per ton	£81	£81	..
a " Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C),	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	8d.	8d.	..
a " Caustic (76/80%) ..	per ton	£24	£24	..
a " Bisulphate	per ton	£85	£85	..
a Shellac	per cwt.	114/-	117/-	3s. dec.
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 5	£6 5	..
a " Recovered	per ton	£5 10	£5 10	..
a " Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a " Crystals	per ton	£8	£8	..
a Bichromate, casks ..	per lb	2¼d.	2¼d.	..

METALS, &c.				
b Aluminium Ingots, in ton lots	per ton	£148	£148	..
b " Wire, in ton lots	per ton	£224	£224	..
b " Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£75 to £125	£75 to £125	..
c Brass (rolled metal 8" to 12") basis	per lb.	6⅞d.	6⅞d.	..
c Tube (brazed)	per lb.	8¼d.	8¼d.	..
c " " (solid drawn) ..	per lb.	7d.	7d.	..
c " Wire, basis	per lb.	7d.	7d.	..
c Copper Tubes (brazed) ..	per lb.	8⅜d.	8⅜d.	..
c " " (solid drawn) ..	per lb.	9d.	9d.	..
g Copper Bars (best selected) ..	per ton	£71	£71	..

METALS, &c. *(continued.)*		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£71	£71	..
g " Rod	per ton	£71	£71	..
c " Electrolytic) Bars ..	per ton	£63	£63	..
c " " Sheets ..	per ton	£75	£75	..
c " " Rod ..	per ton	£68	£68	..
c " " H.C. Wire	per lb.	8d.	8d.	..
f Ebonite Rod	per lb.	8/-	8/-	..
f " Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	3/0½ to 3/1	3/1½ to 3/2	1d. dec.
i Iron, Charcoal Sheets	per ton	£18	£18	..
i " Pig (Cleveland warrants) ..	per ton	47/2	46/11	3d. inc.
i " Forgings, according to size	per ton	From £11	From £11	..
i " Scrap, heavy	per ton	47/6 to 50/-	47/6 to 50/-	..
i " Wire, galvanised No. 8 ..	per ton	£9 15	£9 15	..
g Lead, English Ingot	per ton	£11 10	{£11 12 6 to £11 15}	2/6 to 5/- dec.
g " Sheet	per ton	..	£13 10	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£8 15	£8 15	..
d Mica (in original cases), small ..	per lb.	8d. to 9d.	8d. to 9d.	..
d " " " medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d " " " large ..	per lb.	5/8 to 7/8	5/8 to 7/8	..
p Phosphor Bronze, plain castings	per lb.	11¼d. to 1/2	11¼d. to 1/2	..
p " rolled bars & rods	per lb.	1/- to 1/3	1/- to 1/3	..
p " " strip & sheet	per lb.	From 1/2	From 1/2	..
o Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	10d. to 1/-	10d. to 1/-	..
i Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15	to £40	..
i " " in bars		£58	£58	..
g Tin, block	per ton	{£127 to £128}	{£119 to £120}	£8 inc.
g " foil	per lb.	1/6	1/6	..
n " wire, Nos. 1 to 16	per lb.	1/7	1/6	1d. inc.
p White Anti-friction Metals —				
"White Ant" brand	per ton	£85 to £65	£85 to £68	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	7d.	7d.	..
j " 8 lea. Flax	per lb.	5¾d.	5¾d.	..
j " 3 ply 10 lbs. Russian ..	per lb.	4 13/16d.	4 13/16d.	..
j " 10 lbs. Russian, single ..	per lb.	4⅛d.	4⅛d.	..
j " 180 lbs. June rove	per ton	£10 2 6	£10 2 6	..
h Zinc, Sh's. (Vieille Montagne bnd.)	per ton	£22 10	£22 10	..

Quotations supplied by: a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by: f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakspeare. [Co., Ltd. h Messrs. Edward Till & Co. i Messrs. Bolling & Lowe. j Messrs. Walter H. Hindley & Co.

Quotations supplied by: k Messrs. Morris Ashby, Limited. m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company, Ltd.

100,018	Westminster Electric Supply, Ord.	...	...	...	5	13 %	10½ %	10½ %	11 — 12	11 — 12	12½	...

* Subject to Founders Shares.
‡ Unless otherwise stated all shares are fully paid.
§ Dividends marked § are for a year consisting of
† Quotations on Liverpool Stock Exchange.
‖ Dividends paid in deferred share warrants, profits being used as capital.
the latter part of one year and the first part of the next.

ELECTRICITY WORKS AND THE SUPPLY OF ENERGY FOR CORONATION ILLUMINATIONS.

The following is a copy of the series of questions which were sent out by us to station engineers asking for information as to what was being done in connection with their system by way of preparation for Coronation supply, and a brief summary of the replies so far to hand :—

1. What special arrangements, if any, do your works contemplate making to meet the demand for energy for Coronation illuminations ?

2. Will there be any special price charged for electrical energy ? If so, what is proposed ?

3. Are there any special facilities to be given for tapping mains ?

4. Are your own works and municipal buildings to be electrically decorated and illuminated ?

Accrington.—Mr. H. Gray reports: (1) That being midsummer no special arrangements are considered necessary. To (2) and (3) he replies, No ! (4) The municipal buildings will probably be electrically illuminated.

Ayr.—Mr. A. J. Fuller says that a general scheme is now under consideration.

Bangor (N. Wales).—Mr. P. F. White states that Committee is about to consider.

Barnes.—Mr. C. S. Davidson says demand for this class of supply small. No steps yet taken. Electricity works and Council offices likely to be illuminated.

Barnsley.—Mr. S. E. Bastow reports no special arrangements as to (1). All current for one week will be charged at special low rate—probably 2d. per unit.

Bath.—Mr. Francis Teague. Corporation not yet decided.

Battersea.—Mr. H. R. F. Mackay gives four interesting replies. (1), None. (2), (3) and (4), No.

Bedford.—Mr. R. W. L. Phillips. Matter receiving attention.

Birkenhead.—Mr. W. Bates. (1) None. (2) Question not yet mooted. (3) No. Electricity Committee will supply energy free for the illumination of the municipal buildings.

Blackburn.—Mr. A. S. Giles says that the scheme adopted includes the free supply of electricity for illuminating purposes to all consumers. (3) No. (4) Not definitely settled.

Bolton.—Mr. A. A. Day. (1) Special arrangements unnecessary as plant sufficient. (2) Supply for illuminating Corporation buildings free. Private consumers' charges not settled. (3) Nothing definite settled, but this would not be objected to if done under superintendence of electricity department. (4) Yes.

Brighton.—Mr. J. Christie. (1) Prepared to supply any demand within the plant capacity. (2) No special price, but any increase on the winter maximum demand will not be reckoned against the consumer at the higher rate (7d.), but at 1d. (3) No special facilities. Any one of the 3,000 odd consumers can have whatever energy he likes up to capacity of service mains. If special mains required, consumer must pay for same. (4) Electricity works being in unimportant thoroughfare, will not be illuminated, but Town Hall and other municipal buildings will be, on lines not yet definitely decided.

Bristol.—Mr. H. F. Proctor says: (1) Plant sufficient for anticipated demand. (2) Ordinary rates. (3) Temporary supply will be given when in proximity to mains. (4) Electricity works, no; municipal buildings, yes.

Burnley.—Mr. R. Birkett. (1), (2) and (3), no. (4) Probably.

Burton-on-Trent.—Mr. F. L. Ramsden (gas and electric light works). No special arrangements made, though it is expected that the large breweries will go in extensively for electrical illumination, energy being charged at ordinary rates.

Bury St. Edmunds.—Mr. L. P. Greig. Council not yet settled the matter.

Canterbury.—Mr. C. A. Blascheck. Committee not yet made arrangements.

Cardiff.—Mr. Arthur Ellis says: (1) No special arrangements considered necessary to meet demand. (2) and (3) No special charge for energy, cost of special temporary service connections to be charged to consumers. (4) Electricity works outside town, so no ; municipal buildings not yet decided.

Carlow (Ireland).—Mr. G. M. Harris. (1) No very great demand anticipated. (2) Ordinary price. (3) If necessary, every facility will be given. (4) Electricity works, yes ; municipal buildings, not likely.

Charing Cross and Strand E.S. Corporation, Limited.—Mr. W. H. Patchell. (1) Large amount of plant available representing the difference between summer and winter loads ; in addition there is the new plant at Bow. (2) Special charge of 5d. plus cost of connections. (3) All inquirers are being notified that they will be met as far as is possible with safety. (4) Not settled.

Chelmsford Electric Lighting Company, Limited.—Mr. A. H. French says nothing has yet been done.

Chelsea Electricity Supply Company, Limited.—Mr. P. Still. The company is sending out a circular relating to the matter offering to give every facility to customers requiring additional current for illuminations. The circular says :—"The amount of current which can be supplied for this purpose being limited, customers are requested to give notice as early as possible of their intention to take an increased supply. Applications must be made on special forms, which may be obtained at the offices of the company or from the wiring contractor. *No application can be entertained* unless received *at least two weeks* before the supply is required. Full details of the arrangements proposed must be submitted to the company by the contractor. *Charges.*—A charge of 10s. 6d. will be made to cover the cost of connection and testing. Should special connections and larger meter be necessary, the charge will be one guinea. The current used will be charged for by meter at the ordinary rates." As to question (4), works may be illuminated.

Cheltenham.—Mr. H. Kilgour reports :—(1) Ample plant for meeting any probable demand ; no special arrangements contemplated. (2) Propose charge of 2d. per unit throughout Coronation week to all customers who pay 2s. 6d. to cover the cost of reading the meters at the beginning and end of the week. (3) Temporary services, &c., and alterations to services and meters to be paid for at cost price. (4) Works 1½ miles from the town, so will not be decorated ; no decision come to regarding municipal buildings in the town.

Colchester.—Mr. A. R. Sillar says: (1) It is not expected that the Coronation load will be up to that of an ordinary weekday. (2) No special rate had been fixed, but it is proposed to charge maximum price. (3) No. (4) Municipal buildings will be.

Cork.—Mr. H. H. Nalder. Quite uncertain.

Coventry.—Mr. J. A. Jeckell writes that no illuminations are proposed at present.

Crewe.—Mr. H. H. Denton says that demand for Coronation illuminations so small that no special arrangements or rates are necessary.

Darlington.—Mr. J. R. P. Lunn. So far nothing done.

Darwen.—Mr. Chas. Garnett says: (1) No special arrangements needed, as there is sufficient spare plant. (2) All consumers to have free current on Coronation night for outdoor illumination only. (3) For connecting to main free up to 20 yards ; if over, cost price charged. (4) Whole of municipal buildings and works.

Derby.—Mr. T. P. Wilmshurst. No arrangements yet made.

Devonport.—Mr. Chas. Furness. Nothing to report yet.

Doncaster.—Mr. W. Wyld. Discussed, but nothing settled at present.

Dublin.—Mr. M. Ruddle. (1) No application yet received. (2) Special price will be arranged for any favourable demand. (3) Must be taken off existing supplies generally. Special applications considered on merits. (4) Nothing at present arranged.

Dundee.—Mr. W. H. Tittensor. (1) Under consideration. (2) Probably cost price for town, private consumers, no. (3) No. (4) No (works situated in slums, next door to graveyard, and Mission Hall, with a jail at the back and a public house in front).

Durham.—Mr. J. S. Frain says: (1) No. (2) Demand indicators will be short-circuited during June. (3) No. (4) Probably.

Ealing.—Mr. J. D. Knight. Nothing yet decided.

East Ham.—Mr. W. C. Ullmann. (1 and 2) Nothing arranged. (3) No. (4) No.

Eccles.—Mr. H. W. Angus. No special arrangements contemplated.

Edinburgh.—Mr. F. A. Newington. Nothing settled yet.

Exeter.—Mr. H. D. Munro. (1) None required. (2) Probably 4d. per unit. (3) Not contemplated. (4) Yes.

Farnworth.—Mr. J. D. Pember says that there is plenty of spare power at present. All consumers will be supplied free for Coronation Day, the electricity department reserving the right to object to any wasteful illuminations. Special tappings may be allowed for illuminating buildings not now connected, but cost of the work would be charged. (4) Most likely, but not decided.

Fleetwood.—Mr. O. Hansom: (1) No demand expected. (2) and (3) No. (4) Probably.

Folkestone Electricity Supply Company.—Mr. T. Hesketh: No arrangements made. Probably beyond meeting consumers' requirements, no special facilities will be given.

Fulham.—Mr. R. F. Ferguson : (1) None. (2, 3 and 4) No.

Glasgow.—Mr. W. A. Chamen writes that there is no inclination to encourage such illuminations, owing to time of year.

Gloucester.—Mr. W. J. Bache. (1) None. (2) 2d. per unit. (3) Laid at cost price. (4) Probably not.

Govan.—Mr. J. Brown. Nothing definitely settled.

Greenock.—Mr. W. M. Nelson. Being considered.

Grimsby.—Mr. W. A. Vignoles. (2) 2½d. per unit (half price). (3) Laid at cost price. (4) Electricity works and Town Hall.

Guernsey.—Mr. A. G. Bird. (1) Not encouraging temporary lighting. (2) 7d. per unit. (3) No. (4) No.

Hackney.—Mr. L. L. Robinson reports :—(1) No special arrangements necessary. (2) ¾d. per 30-watt lamp or its equivalent per night. Charge of 10s. 6d. to cover cost of temporary connection, testing and disconnection. (3) Consumer bears cost of special service connection ; if he becomes a permanent one within three months, charge for the service to be refunded. (4) Undecided.

Halifax.—Mr. W. M. Rogerson. No arrangements yet made.

Hampstead.—Mr. G. H. Cottam :—(1) None. (2) Ordinary rates, lower scale 2½d. through demand indicator. (4) Not settled.

Harrogate.—Mr. G. Wilkinson is engaged placing proposals before Committee.

Hastings.—Mr. L. Andrews. No decision yet.

supplied by | d Messrs. F. Wiggins & Sons. | e Messrs. Frederick Smith & Co.

supplied by | i Messrs. Bolling & Lowe. | j Messrs. Walter H. Hindley & Co.

supplied by | o Messrs. Johnson, Matthey & Co., Ltd. | p The Phosphor Bronze Company, Ltd.

Hereford.—Mr. F. G. Poulton:—(1) None. (2) 4d. per unit for all current consumed during Coronation week, meters being read before and after. (3) No; all current must be taken off present cut-out boxes. (4) Municipal buildings use gas; nothing at works.

Islington.—Mr. A. Gay:—(1) None. (2) 1d. per 8-c.p. lamp per night (as per Southwark Conference Rules). (3) No. (4) Not yet decided.

Kendall.—Mr. T. N. Ritson. Works open about Coronation time. Display contemplated.

Kensington and Knightsbridge Electric Lighting Company.—Mr. G. C. Weston. Consumers being circularised specially. Company prepared to supply current to temporary illuminating devices up to the limit of the distributing capacity available. Applications to be made upon special forms. Applications to be sent in as soon as possible, as they will be dealt with in the order of their date. Full particulars of all illuminating devices to be submitted to the company, for approval, at their distributing department, Prince Consort Road, South Kensington. All work must be carried out, as far as possible, in accordance with the general rules issued by the company, and special precautions must be taken for the protection and insulation of all outdoor work exposed to the weather. All work must be inspected and tested by the company's inspector before a supply will be commenced.

Connecting, &c., Charges.—1.—Where the current for the illumination supply is taken through the existing service, meter, fuses, &c., and where the current for the illumination supply and for the existing lighting, both being in use at the same time, does not exceed the capacity of the service, &c., the charge for inspecting and testing by the company will be 10s. 6d.

2. Where the illumination supply is taken through the existing service cable, but a larger temporary meter and larger fuses are required, the charge, including inspecting and testing, will be £1.

3. Where a new service is required for temporary use, provided the company have distributing mains laid and a manhole box outside the premises, suitable for direct access into the same, and provided the service does not exceed 10 ft. in length, the charge for connecting, &c., a device demanding a supply adequate for:—

a) Fifty 8-c.p. lamps, or equivalent	£3 0 0
(*b*) Over 50 and under 125 8-c.p., or equivalent	3 10 0
(*c*) Over 125 and under 250 8-c.p., or equivalent	4 0 0

And for every additional 10 ft. of service, or part thereof, or for every additional 125 8-c.p. lamps, or their equivalent, or part thereof, a sum of 10s. must be added to the above charges for connecting, &c.

4. When a new service is required for temporary use, necessitating the footway or roadway to be taken up, special quotations will be given upon receipt of full particulars, For this work at least eight weeks' notice must be given to the company.

Four weeks' notice must be given where it is only necessary to change the service cables, meter, fuses, &c.

The pressure supplied to all these illumination services will be at 200 volts continuous current.

Supply Charges.—The charge for current supplied through an existing service and meter will be at the ordinary rates.

The minimum charge for a supply through a special service will be for each evening's use as follows:—

(*a*) Up to 50 8-c.p. lamps, or their equivalent	5s. 6d.
(*b*) Over 50 and under 125 8-c.p. lamps, or their equivalent	12s. 6d.
(*c*) Over 125 and under 250 8-c.p. lamps, or their equivalent	25s. 0d.

For any quantity beyond the minimum the charge will be at the ordinary rate per unit.

The company will require the charges for connecting and testing and the supply charges for special services to be paid in advance before any work is commenced.

Note.—The company will not provide any illuminating devices, nor will they fix them. Consumers must employ their own contractors to carry out this work.

King's Lynn.—Mr. J. Pilling. Matter not considered.

Kingston-on-Thames.—Mr. J. E. Edgcome. (1) Bulk of shop load being off, present plant will suffice. (2) Committee not decided. (3) Temporary connections to mains at cost price. (4) Town Hall and possibly other public buildings.

[Borough will have special Millenary celebrations at Whitsuntide (Saturday to Monday, May 17th, 18th and 19th) to commemorate the crowning at Kingston of Edward the Elder, and Town Hall will be illuminated then.]

Lancaster.—Mr. W. A. Tester. (1) None. (2) No. (3) If required. (4) Municipal buildings.

Larne.—Mr. M. G. Smyth. Matter not considered.

Leeds.—(1) Plant quite equal to demand. (2) Ordinary charges. (3) Little likelihood that extra services will be required, but if so would probably be charged for. (4) Electricity works, No. Municipal buildings, Yes.

Leith.—Mr. J. Gray Scott. No definite arrangements. Matter under consideration of the Provost's Committee of the Council.

Lewes.—Mr. F. H. Davies. (1) None. (2) Maximum demand indicators will be reset after illuminations, so as not to interfere with consumers' usual maximum. (3) Would be considered on application. (4) Probably municipal buildings.

Leyton.—Mr. F. Harman Lewis. Nothing decided.

Limavady.—Mr. E. J. S. Ritter. Nothing.

Liverpool.—Mr. A. B. Holmes. (1 and 2) No. (3) All necessary facilities given. (4) Municipal buildings.

London (City of London Electric Lighting Company).—Mr. J. C. Bull (manager). (1) Ample plant and reserves to meet any demand. (2) Owing to the temporary nature of the demand, a charge will be made, varying with the nature of the work in each case, to cover the cost of connecting and disconnecting, but the minimum charge will be £1. The rate of charge for energy will be 2½d. per 8-c.p. lamp for each day of 24 hours that the lamps are connected to mains. A part of a day to be counted as one day. A 16-c.p. lamp will be charged at 5d., and so on as regards other sizes of lamps, for the same period. This rate is, of course, subject to the condition that the lamps will be switched off during daylight hours, and the company reserve the right to require payment of a proportionately higher rate if the lamps are used in the daytime. (3) Engineering department will give every assistance.

Longton.—Mr. W. Langford. Nothing definite decided. Committee has offered to supply illumination devices at cost price, and current for public buildings free of charge.

Luton.—Mr. W. H. Cooke. Committee to consider shortly.

Morecambe.—Mr. R. Pape. Nothing to report.

Morley.—Mr. H. Drewett. (1) None. (2) and (3) No. (4) Municipal buildings probably.

Nelson.—Mr. W. A. Fraser. Ordinary rates. (3) No. (4) Yes.

Newcastle and District Company.—(1) No. Can give supply of energy from transformer sub-stations, if desired. (2) Not settled yet. (3) No; only from transformer station. (4) Works, no.

Northallerton.—Mr. F. R. Batty. Very little illumination will be done. Plant equal to 50 kw. above usual load. (2) Usual prices.

Norwich.—(1) None necessary. (2) No. (3) Probably. (4) Yes.

Nottingham.—Mr. H. Talbot. No particular demand expected.

Notting Hill Electric Lighting Company, Limited.—Mr. G. Schultz. (1) None. (2) and (3) No. (4) Offices only.

Pembroke (Ireland).—Mr. Price. (1) None. (2) and (3) No. (4) Uncertain.

Penarth.—Mr. S. G. Leech. (1) No. Plant can deal with 100 per cent. increase of load. (2) Indicator readings will not be noted in June. (3) All possible encouragement to be given. (4) Works probably; municipal buildings not decided.

Perth.—Mr. J. Lambert. (1) No. (2) No special charge; demand indicators to be cut out of circuit during Coronation period. (3) No. (4) Municipal buildings and town churches, but not electricity works.

Plymouth.—Mr. E. G. Okell. (1) Connections will be made up to capacity of plant. (2) 32 lamps of 8 c.p., 4½d. per hour's use; if meters already fixed, 4½d. per unit. (3) Cost of temporary connection charged.

Poplar.—Mr. A. Blackman. No special arrangements, prices, or facilities to be held out to the public to induce them to adopt electricity for temporary lighting, as it is not wished that this demand shall be encouraged. Wiring rules provide that no current shall be supplied to installations of a temporary nature. Public buildings likely to be electrically illuminated.

Portsmouth.—Mr. E. Price:—(1) None contemplated. (2) and (3) No. (4) Town Hall no doubt.

Queenstown.—Mr. H. Nalder. No demand anticipated.

Rathmines.—Mr. G. F. Pilditch:—(1) (2) and (3) No special arrangements. (4) Under consideration.

Rochdale.—Mr. A. C. Atchison:—(1) Demand for special arrangements not anticipated. (2) 3d. per unit where supply mains are already laid down. (3) For purely Coronation illuminations, charge for connection to mains; those who retain supply will not be charged. Consumers who are connected and require an excessive supply will be charged as above unless extra service is retained for future use. (4) Municipal buildings proposed.

St. Helens.—Mr. J. S. Highfield:—(1) None. (2) Probably 6d. (3) As required. (4) Probably.

St. Pancras.—Mr. A. E. Pycraft. Under consideration.

Salford.—Mr. C. D. Taite. In the hands of a Special Committee.

Sheffield.—Mr. S. E. Fedden:—(1) None. (2) and (3) Not decided. (4) Yes.

Shoreditch.—Mr. C. N. Russell. Not yet decided.

Smithfield.—Mr. E. Ridley. Applications treated on merit. (4) No.

Southport.—Mr. R. S. Downe:—(1) None. (2) Outside illuminations ½d. per night per 16-c.p. lamp. (3) Where required. (4) Public buildings, supply gratis.

Stirling.—Mr. A. C. Hanson. (1) None. (2) No. (3) No. Season unfavourable for illuminations.

Stepney.—Mr. W. C. P. Tapper. (1) No large demand anticipated. (2) No special price; but as demand indicator readings are not taken in summer months, all current for illuminations will practically be at 1d. per unit. (3) No.

Stockport.—Mr. S. Meunier. Nothing arranged.

Sunderland.—Mr. J. F. C. Snell. (1) Demand for illuminations cannot occur until long past the peak of the load, and all shops will be closed on Coronation day, therefore there can be no difference to normal maximum demand. (2) At the time of 1897 Jubilee, the Town Hall special illuminations only represented for two nights £4 worth of current. Special prices not worth while. (3) Facilities will be given where necessary. (4) Works, no. Town Hall, Public Library, and Technical College, yes.

Sutton.—Mr. M. Nash. (1) None. (2) D.I. readings will be ignored during June; energy for decorative purposes at lowest rate, 2d. per unit. (3) Every encouragement will be given. (4) Yes.

Torquay.—Mr. P. Storey. (1) Applications must be made three weeks prior to Coronation. (2) Free of charge. (3) No. (4) Municipal buildings, yes.

Tunbridge Wells.—Mr. H. Boot. (1) Unnecessary, as the Coronation takes place in summer, but spare transformers, if required, will be taken from the spare stand-by and placed in the sub-stations nearest to the required premises. (2) Not proposed. (3) Where necessary. (4) Municipal buildings.

Walsall.—Mr. A. Wyllie. No special arrangements.

Walthamstow.—Mr. F. A. Wilkinson. (1) None. (2) and (3) No. (4) Not decided.

Watford.—Mr. W. H. F. Colebrook. (1) None. (2) M.D. indicators will probably be short-circuited during the time the illuminations are on. (3) Probably. (4) Undecided.

West Ham.—Mr. J. K. Bock. Nothing definite done yet.

current for illuminations. The circular says:—The amount of

West Bromwich.—Mr. J. H. Wray. (1) None. (2) D.I. will be cut out for two nights where extra lights are used. (3) No. (4) Municipal buildings by gas.

Westminster Electric Supply Corporation, Limited.—The company is circularising its area expressing itself as "anxious, by supplying additional current, to afford every facility to those of their consumers who desire to illuminate their premises. The amount of current which can be supplied for this purpose is limited, and it is necessary that the company should have ample time to make arrangements. Consumers are, therefore, requested to decide upon their requirements and to give their contractors full instructions as early as possible. The following rules will be adhered to:—

1. Applications for supply to a moderate number of lamps will be accepted in the order in which they are received until the limit of power which can be allotted for this purpose is reached, but no applications can be entertained unless received at least two months before the supply is required.
2. Applications for supply must be made on special forms, signed by the consumer, which may be obtained at the company's office or through the wiring contractors. No verbal application can be entertained.
3. Full details of the arrangements proposed must be submitted by the contractor to the company one month before, and the work must be completed in position and be ready for testing seven days before the supply is required.
4. The company reserve the right to refuse any application.

CHARGES.

1. A charge of 6d. per 8-c.p. lamp connected (with a minimum of £1) will be made, to cover the cost of special connections and testing.
2. The current used will be charged for by meter at the ordinary rates.

NOTE.—The charge for current may be taken roughly at 1d. per 8-c.p. lamp per night, so that a consumer installing 50 8-c.p. lamps and using these for seven nights would pay the company

For connection	£1	5	0
For current (approximately)	1	9	2
	£2	14	2

The cost of fitting and interior wiring is not included in the above. This is a matter between the consumer and his contractor.

Weston-super-Mare.—Mr. S. G. Leech. (1) Plant sufficient to meet demand. (2) No special rate, but max. demand readings during June will not be considered when making out accounts. (3) Temporary connections wherever possible.

Wigan.—Mr. H. C. Bishop. Nothing arranged, but current will probably be supplied at reduced rate. (3) No.

Wimbledon.—Mr. F. B. Spencer. (1) Not decided. (2) Mr. Spencer has recommended a low special tariff to committee. (3) As required; engineer favours connection from cut-outs direct at special rate to avoid consumption being metered. (4) Recommended by engineer.

Worcester.—Mr. C. J. Sutherland. (1) Plant ample for expected demand. (2) For illumination purposes 3d. per unit. (3) Those not already consumers must pay cost of such connections. (4) Municipal buildings, Yes. Works, No, as two miles in the country.

Wolverhampton.—Mr. C. E. Shawfield. The following charges are proposed:—

Charge per 16-c.p. lamp per night.	Equivalent to.
At the rate of 5s. per 100 lamps up to 300 lamps	3d. per unit.
At the rate of 4s. per 100 lamps from 300 to 500 lamps ..	2½d. ,,
At the rate of 3s. 8d. per 100 lamps above 500 lamps ..	2d. ,,

A charge to existing consumers will be made to cover the cost of the special connection, and disconnection, as follows:—Up to 300 lamps, 2s. 6d.; from 300 to 500 lamps, 3s. 6d.; above 500 lamps, 5s. In those cases where a supply of electricity is required, and no service exists, special arrangements for connection will be necessary.

[Several late arrivals are held over until next week.—EDS. E. R.]

ARTISTIC ELECTRICAL ILLUMINATIONS.*

BY EDWIN O. SACHS, Architect, A.M.I.Mech.E.

THE subject you have selected for discussion this evening is, no doubt, one eminently appropriate to a time when many of our fellow citizens are thinking of showing their loyalty by a patriotic display of illumination devices on the fronts of their places of business, or at their private residences. How I should, however, have come to the honour of being selected to deal with this subject, I really do not know, inasmuch as I had never before spoken on anything relating to the artistic side of architecture, much less to any question of decorative art, but, in fact, have generally limited myself to questions of technical or constructive importance.

Perhaps my selection has something to do with the fact that by many curious coincidences, I have, during my travels and frequent visits abroad, seen much of illuminations on many festive occasions, and that I am able to tell you something about the doings in countries which, I may almost say, "specialise" in demonstrating their loyalty or joy by illuminative displays.

It may be, however, that I have been called upon to speak as one who, as an amateur, takes considerable interest in electric lighting and stage lighting, and the lighting of public buildings in particular, and who, in a sordid moment, having assisted in the development of a certain electrical system, and certain electrical devices, had the impertinence to interest himself financially in what I believe may shortly revolutionise the whole problem of rapid and artistic electrical illumination. I here refer to my association with what is generally known as the E.L.B. system of electric lighting, brought out by a company trading under the name of Electric Lighting Boards.

Whatever the actual reason may have been, I will approach the subject to-night, firstly, as an architect; and, secondly, as one who has travelled; and, thirdly, as one who believes (rightly or wrongly) that there is now at least some means of economically and rapidly employing electricity for special temporary effects in an artistic manner, and also a system which will far supersede everything that has been done before, and more particularly supersede the ugly gas flare and the hideous gas jet that has been used in the metropolis until we are not only tired of their vulgar presence, but will only too gladly abandon them for all time.

As an architect, I mainly look upon electrical illuminations as a simple and rapid manner of outlining the façades of public buildings, marking the important features of public thoroughfares, and generally applying the principles of architectural design in showing up the features of a building or thoroughfare by artificial light.

As a traveller, I may say that I know every European capital and many of the minor towns, and have attended in some form or other many of the great ceremonies of the past decade, not only near by in Paris, Berlin, or Vienna, but also in the more distant St. Petersburg, Warsaw, or Stockholm; I must draw attention to the fact that with few memorable exceptions (notably last year at the Glasgow Exhibition) we are really behind the rest of the world in our attempts at illuminations.

As an amateur electrician, and one who, when attempting to design effective decorative schemes in electrical work, has frequently met with difficulties of execution and expense, I speak to-night as one who believes that with the new E.L.B. system, which I have helped to nurse, these difficulties have at last been surmounted.

I am not going to trouble you with a lot of historical detail as to the evolution of electrical illuminations or of illuminations generally, for I believe an audience such as I see before me would rather hear something relating to the practical application of artistic electrical illumination than to the gradual evolution of the illumination schemes of to-day.

Nevertheless, I cannot but remind you that this whole question of artistic illumination is one of very, very long standing, and anyone acquainted with history will know how the great Roman emperors, and before them the Greeks, and before them, again, the Egyptians, on occasions of great rejoicing, would at night arrange special displays of artificial lighting. Such illuminations have also found a place in many of the great religious ceremonies that have been brought down to us from century to century, and anyone to-day visiting Russia will remember how on special occasions of religious importance there are great displays not only of illuminations but also of fireworks.

The application of many small lights at night has from time immemorial been the means of expressing joy.

In Russia and in the Slavic, Latin and Teutonic countries, illuminations have always been much favoured during the last three centuries, and anyone coming across old prints will frequently find illustrations showing what was done at the time. I myself recently came across a print showing how the historical buildings of Nuremburg were illuminated on May 13th, 1774, in a manner that would make us envious, although we now have electric light, and in those times they only used small oil lamps.

But I will not enter into any detailed description of the various illumination appliances utilised prior to the introduction of electric light; yet I must just touch on some of them.

The small earthenware pan, for instance, filled with tallow and a wick, was an appliance used for a considerable period.

Candle illumination devices, protected by lamp shades, either of glass or some other semi-transparent material were popular illumination appliances for many years.

Then we have had the various forms of small lanterns made of metal, and the innumerable paper appliances generally described as Chinese lanterns. Of course, these Chinese lanterns were originally intended, and are still intended, in the main to be used with candles. They are quite unsuitable for gas, but on the other hand, they are used with considerable effect as a covering for electric lights. Again, if we go to a country like Italy, we shall find the application of water plays a considerable part in the illumination appliances. Thus, you will find glasses filled with water on which a kind of night light is floating, and the light throwing its rays through the water makes a charming effect. As a matter of fact, in Italy the water thus used is frequently coloured. Another form of illumination appliance, originally intended to be used with candle light or with oil lamps, is transparency, which, of course, nowadays is also used with gas light or electric light, the idea being to simply draw the illumination device on a sheet of semi-transparent material, behind which lights are placed in order to show up the device in question.

But before leaving candle light, perhaps I should remark that the most wonderful effect that I have ever seen as to the application of candles was at the celebration of Emperor William the First's eightieth birthday at Berlin, when, by special arrangement, the entire city of Berlin placed six or eight candles on the lower sill of every window in a row so that there was not a window in the whole city of Berlin that had not got its row of lights in practically an identical position. Even in the slums the candles were provided gratis by public subscription; and, similarly, landlords having unlet houses, and not wishing to spend the money on these

* A paper read before the Society for the Encouragement of the Fine Arts.

unlet houses, were provided with candles. I consider that a simply organised effect of this description, arranged with the most primitive of materials, but arranged simultaneously by a community of some one million souls in buildings covering many square miles, was the most effective and impressive form of illumination that has ever been or is ever likely to be seen, and absolutely eclipses individual efforts to shine. What, may I ask, would the effect have been if, instead of candles in windows, the citizens could have arranged plain lines of electric lights along the fronts of the buildings?

Turning back, however, to gas light, we, in the first instance, find the various forms of partially outlining buildings, the preparing of devices and the like in plain gas-piping with little holes bored into the piping equally spaced, from which light is given. Such outlining with plain, simple gas-lights is certainly effective, if the idea of a really plain outline is retained; but, as a matter of fact, too much ambition has been shown with the view of making pretty devices, and ugliness as a rule results. These plain, punctured lights are particularly ugly if utilised for letters or emblems. The only device I know for these plain gas-burners that is in any way artistically effective is the star, owing to its simply being a number of plain rows meeting in one centre; but the star is comparatively rare.

The next form of this plain gas outlining is a development by the application of a small burner, which does not, however, to any extent improve matters.

The next step is the application of a small glass globe above the burner, the glass globe being frequently coloured.

By this means gas can certainly be made an effective illuminant, as long as plain straight work is done; but here, again, the moment decorative devices are used I do not consider the effect at all good. In fact, it is most tawdry, as many will remember who saw the last Jubilee illuminations at the Bank and Mansion House.

Lastly, as far as gas is concerned, comes the very popular application of ordinary gas jets behind crystal emblems. These crystal emblems are essentially national, and are scarcely met with anywhere else outside England, and I must say that their application in certain directions can be made highly artistic; but here, again, the moment simplicity is left for complicated designs nothing but ugliness results.

Before leaving this question of gas illumination, I should like to trace a walk I took down some of the main thoroughfares of the West End on the occasion of the King's Birthday of November 9th last. I wish I had made my notes more detailed, but I had no idea of this lecture impending, and I really only made notes for my own private information.

The route I took was from the Langham Hotel, Portland Place, down Regent Street to Piccadilly Circus, along Piccadilly to Bond Street, up Bond Street to Oxford Street, along Oxford Street to the Marble Arch and down Park Lane and Grosvenor Place to Victoria Street. Then, passing Westminster Abbey, I went up Whitehall, the home of the great public offices, along Pall Mall, finishing with St. James's Street.

The Langham Hotel had nothing to show.

The Queen's Hall was similarly a mass of darkness.

The Polytechnic was a void, and looking up and down Mortimer Street I saw nothing. The first star I saw was over Messrs. Wyon's (No. 287), and that was an ordinary small gas star. Messrs. Lobb (No. 296) had a simple E.R. Nos. 292 and 280 had a plain line of lights. This was all the illumination I found north of Regent Circus.

The actual Regent Circus was in darkness, but Messrs. Jay's had a very big, ugly, although very ambitious, gas-jet display facing Regent Street. It was supposed to be emblematical, but, as the lights were being constantly blown out, the whole appearance of this device was most restless.

Opposite Messrs. Verrey's there was an E.R.

Messrs. Swears & Wells had an exceedingly vulgar kind of whirligig crystal display with balls and stars moving automatically. I assume this was supposed to be something novel, but its taste was execrable.

Messrs. Lewis & Allenby had a badge; Messrs. Brooks and Messrs. Vickery's likewise sported badges.

At No. 146, Messrs. Rowlands & Fraser sported a gas star and an E.R., whilst Messrs. Carrington, No. 130, were satisfied with a badge.

The device of Messrs. Scott Adie was the first of any artistic pretentions. This comprised a large thistle design worked out in crystals backed by gas jets, and in colouring and effect it was certainly as good as anything could be in this crystal work.

The Goldsmiths' Company had a tiny little electrical badge or frame surrounding the King's head, rather pretty in itself, but insignificant. The main merit of this badge lay in the fact that it was the first electrical device I had come across all the way down Regent Street, and hence aspired towards some degree of novelty.

Messrs. Johnson, the hatters, sported a badge, and, I believe, three gas stars.

The new Imperial Restaurant, which had just been fitted up, had a couple of very common badges and a crown, looking remarkably crude against the elaborate picture which they had recently erected.

I now come to Piccadilly Circus.

The Criterion sported some gas flares on the roof, and the whole front of Messrs. Swan & Edgar could only boast of a single badge, whilst looking down Lower Regent Street, as far as I could see, I found that Messrs. Elkington were the only firm with an attempt at display, and they only had a badge.

Turning down Piccadilly, and going westwards, I found badges in front of Messrs. Grant (No. 23), Dobbie (No. 198), Benoist (No. 36), Sotheran & Co. (No. 37), and Lincoln Bennett & Co. (No. 40), the badge of the last-named being a little more ambitious than the others.

Messrs. Woodrow (No. 46) had an E.R.; Messrs. Hatchard (No. 187) a star.

At the corner of Bond Street and Piccadilly, Messrs. Scott, the hatters, had a badge in gas, and some small lamps over the shop-front.

Turning northwards up Bond Street, I saw that Messrs. Grunebaum & Sons (No. 45), and Messrs. Stewart & Co. (No. 46) had badges; Messrs. Hill (3 and 4) a gas star; Messrs. Hummel (No. 6) an E.R., and Messrs. Mitchell's Library were rather more ambitious, for they had a motto, "God save the King," a star and a line of lights over their shop-front in gas. At No. 20, Messrs. Clark had an E.R. and a badge.

Messrs. Barker (No. 5, New Bond Street) had a semi-circular device in gas lamps, Messrs. Henry Lewis & Co. (No. 172) a gas star, Messrs. Morris & Co. (No. 22) a badge, whilst Messrs. Callaghan & Co. (No. 23) had outlined their shop facia, provided an E. and R., and also four stars, the whole making a very creditable display in gas-light. Messrs. Cadbury, Pratt & Co. (No. 24) had a badge with some thistles in ordinary gas lights. At No. 151 there was a badge, and Messrs. Grove & Co. (No. 150) had a star.

Messrs. Savory & Moore (No. 143) had an outline over their shop facia with a sun in the centre, and a crown above this, and E.R. on each side, while Messrs. Johnson, the hatters, had a slight outline and a star.

This was the total of the Bond Street display, that home of the warrant-holders.

Oxford Street to Marble Arch was pitiable, such great establishments as that of Marshall & Snelgrove, with a splendid front, simply appearing as a mass of darkness.

Messrs. Squire (413) alone had a creditable display, a novel one, namely, a large electrical badge, E.R.I., very cleverly designed, and of high artistic merit for this kind of work; the badge was a great deal larger than those usually found, the colour scheme was good, and the whole in good proportion to the building.

Nos. 425 and 456 were the only others I noticed with lights, and these were gas-lights. No. 465 had, I believe, an electrical E.R., but of this I am not sure.

All the way down Park Lane was a mass of darkness, and I hear that South Audley Street and Mount Street were practically the same.

The first creditable display in this part of the West End, as far as private houses are concerned, was Apsley House, the Duke of Wellington's, which had a large motto in gas, "God save the Queen."

Grosvenor Place was a mass of darkness, also the property all round Victoria Station; and Victoria Street, the home of so many Colonial offices, only had a few R's. and a crown.

The only big display in Victoria Street was that of the Electric Lighting Boards Company along the front of Grosvenor Mansions, where the balconies were very carefully outlined in garland fashion, and some very large E.R.'s, crowns, and stars had been grouped on the façade, the colouring being in good taste.

At the end of Victoria Street comes the square which so incongruously has Westminster Abbey on one side and the Aquarium on the other. The Aquarium had some tawdry outline work and some E.R.'s in gas, plain and vulgar.

Whitehall had scarcely anything, although the Admiralty had gone to the length of a gas crown and an E.R. in leaves in the shape of old-fashioned gas jets. The entire Government offices were otherwise in a mass of darkness.

Arriving at Trafalgar Square, I looked down Northumberland Avenue and found that the only effective design was that of the Constitutional Club, which had the words "For King and Constitution" and an E.R. on each side, and rather a neat club badge.

The Hotel Victoria had a primitive attempt in white wood stars with single incandescent lights hanging along the front, looking more like the endeavours of a fifth-rate music hall than those of a first-class hotel.

The Metropole actually had a few flares on the roof; the Avenue Theatre also had a few flares.

Trafalgar Square was practically without any illuminations, but, going up Cockspur Street, I found that one of the shipping companies at No. 16 had a charming ship-badge with a crown above it in crystal with the picture of a ship in the middle, exceedingly well and tastefully done, one of the few attempts at really artistic work.

Pall Mall East had a few R's. and stars in gas.

The whole Carlton Hotel block only showed a crystal badge. This badge was in better colour than those generally made, but was rather poor for so large a block.

No. 7, Pall Mall, the headquarters of the Electric Lighting Boards, had outlined its windows with electric lights, and had a large crown at the top of a semi-circular window and the words "Edward the VII."

I then reached the heart of Pall Mall Clubland, but I am sorry to say that I could find nothing novel here, for the whole of Pall Mall had practically nothing else but the usual gas-flares. Here I should perhaps add that gas-flares themselves, if placed at regular intervals along an entire thoroughfare, are exceedingly effective and dignified, but to find them only here and there on an otherwise black street has a depressing effect, and savours rather of the special illuminations of an asphalting or road-making company, when they do night work with the assistance of naphtha lights.

The final stretch I took was up St. James's Street. Here the Thatched House Club had flares, Nos. 73 and 8 had stars, and a few of the clubs had badges. Chubbs had made some attempt at gas display, an E.R. flanked by two circles centred by a crown.

The Royal Societies Club had some flares, Briggs a couple of stars, Bootles Club an E.R. and a star, and Brooks an E.R. and a crown.

The New University Club had some flares, Hooper's a badge and Thomas's a small outline.

Devonshire Club and White's sported a badge and star respectively.

Fortunately, the *finale* of my round was a pleasant one, for I found that Messrs. Heath, the hatters, had a charming electrical Union Jack, which, I understand, had been specially made up by their own workmen, and which was placed over the corner entrance. This flare, which, I believe, really hails from America in design, was a thoroughly artistic and well-made device of great effect, and was certainly the best individual device on the whole route.

The second item with which I closed my round was Devonshire House, which had its walls outlined with gas, and had some E.Rs. and a crown, but I may tell you that, speaking generally, I went home very depressed as to the taste displayed on the King's first birthday celebration.

Now, from all this, you will see, with what I have already indicated above, that, as far as gas illuminations are concerned, the plain outlining or the plain star are all that I can recommend.

As far as the crystal device is concerned, the plain badges are by far the most effective, such badges as that in front of the P. & O. Office, in Cockspur Street, or some of the plain badges with the Imperial Crown above being far above anything in the more elaborated designs. The moment any tawdry attempts are made at whirligigs or the like, or the outlining of heraldic devices, nothing but failure results.

Now, when moving down these thoroughfares, the one thing that, of course, struck me most was the absence of electric lighting appliances. In all electricity had only been used at points, *i.e.*, at the Goldsmiths' Company, at Squires', in Victoria Street, and at No. 7, Pall Mall, the E.L.B. offices.

Well, gentlemen, this really was something very meagre, and on looking into the question, I found the following, namely, firstly, that Londoners are too conservative to leave gas for electric light easily; secondly, that the electric power companies in London do not seem to have quite grasped the possibilities by which they could make money, and by which they could probably induce their customers to regularly illuminate by electric light instead of gas. The public certainly considered the few electrical devices it saw as superior to what was being done in gas or oil lamps—that is to say, the public expressed itself so frequently, and the Press spoke in this manner. As far as the Victoria Street decorative scheme in particular was concerned, the only large electrical scheme I saw certainly created quite a mild sensation.

But we must, of course, remember that the illuminations on the King's birthday were trivial in the extreme compared with any illuminations one would find in connection with a similar event in any foreign country, or, as a matter of fact, in our own Colonies where electric light has already been used with great effect. We must also not forget that the Scotsman is already ahead of us, for the main buildings of the Glasgow Exhibition were outlined last summer in the best possible style.

But the great difficulty in outlining buildings with electricity in places like London, where labour is dear, has been one of cost. Then the time taken in fixing, and the necessity, as a rule, of keeping to straight line work, form certain drawbacks.

Now, with the impending invasion of the E.L.B. system brought forward by the Electric Lighting Boards Company, the question of expense, the question of time of fixing, and the question of keeping to straight lines has been overcome, whilst what is far more important, those getting out their decorative schemes are not bound to give points in fixing their lights, but can fix their lights wherever they like, and extract and refix their lights at will and without difficulty. Thus, given a straight line of cornice, it may suit the designer to space his lights 2 ft. apart; but on seeing the effect on rehearsal night, he considers the lights too close together. He thereupon simply removes his lights and fixes them in 2 ft. 6 in. apart. This meets with any system requiring lampholders tied to given points. Similarly, he may not wish to have a straight line; he may simply wish to festoon his work, twine his cables around columns. He is quite at liberty to do so, for he can simply unroll his flexible cable off its drum, twine it around anything he likes, festoon, garland, and prick in his lamps wherever he chooses, moving them, if the effect does not please him, until he gets right proportions, right distances, &c., and can give full play to his imagination.

The great difficulty of artistic illumination has always been the design and the comparatively large cost involved in changing the design. All this can now be avoided.

Again, given an electric lighting board, the proud possessor can change his motto, his device, his sentiment at will, by changing his letters, pricking them in wherever he likes. An ardent Liberal who has said "Bravo, C.-B." one night, can put up "Bravo, Rosebery" on the next, if he so wishes, without extra cost.

What can be done in the way of artistic illumination with the assistance of these appliances, may be seen from the experience gained in France, the most artistic loving country in the world. Here we find that when the Czar arrived at Compiègne, and the public authorities wished to do something for him extraordinarily well, and show him something novel, they immediately got hold of these new appliances, and decorated no less than two miles of streets with them in a festoon pattern.

When an art-loving country like France takes up immediately an invention only a few months old, and applies it with high artistic merit, there must be something in it.

What happened at Dunkerque and Compiègne last summer at the time of the Czar's visit has been repeated again and again in that light-loving country, one of the principal demonstrations of late being at the Hotel-de-Ville of Ste-Etienne early in January. But, more recently, the great Victor Hugo celebrations of last week, when a mass of illuminations on the same artistic principles were utilised, showed what could be done.

[Mr. Sachs thereupon, with the aid of illustrations, went on to describe the various decorative schemes that lent themselves particularly to electric lighting, and dealt at some length with the various illumination schemes on the Continent, at Toronto, and Montreal, in connection with the visit of the Prince and Princess of Wales last Autumn.

Mr. Sachs then went on to show the easy application of the Electric Lighting Boards' speciality for artistic illumination schemes, and demonstrated the easy adaptability of the system for rapid temporary work.

For the purpose of demonstrating the application of the Electric Lighting Boards' system, a number of valuable and highly-artistic designs prepared by Mr. Haite, president of the Society of Designers, were shown, several of them having been worked out in materials by Mrs. Hart.

Mr. Sachs closed his lecture by referring to the possibilities of uniform decorative schemes for districts like the City of London, St. James's Street, Pall Mall and Whitehall.]

INSTITUTION OF ELECTRICAL ENGINEERS.

CONSUMERS' INSTALLATIONS.

By Mark Ruddle, Member.

(Abstract of Paper read at Dublin, March 20th, 1902.)

In whatever form the consumer may desire to make use of the supply, the installation of the apparatus requisite for the conversion of electrical energy into light, heat, or motive power, should be on the most efficient lines, both as to convenience and economy in working, and should be so carried out as to be free from all danger to life or property from any cause. Sets of rules for this purpose are plentiful as blackberries in autumn, though scarcely giving such universal satisfaction.

The most satisfactory set of rules yet published is that of this Institution, dated 1897, and with a little revision to bring them thoroughly up-to-date (more especially in the clauses dealing with motive power and heating) they would probably meet all the requirements absolutely necessary as a matter of precaution, if only a universal agreement to adopt them could be come to by all parties.

It seems scarcely reasonable that the representative body of the electrical engineering profession should not be recognised as being best qualified to take an impartial view of the requirements of the industry as a whole. I think, therefore, that the time has now arrived when this Institution should make a determined effort to have itself recognised by the Board of Trade and the industry at large, as the official referee and arbiter of the safety conditions necessary in consumers' installations generally. The present indefinite state of things should not be permitted to exist, in the interest of all parties.

It is manifestly incumbent on the chief engineer of the supply station to see that the conditions under which consumers use their supply shall be such that misuse by one shall not prejudicially affect any other consumer, and that if used legitimately the arrangements and work shall be such that the consumer gets as full beneficial use as possible of the energy for which he pays. He cannot, however, accomplish this alone; he must have the confidence and cordial co-operation of the gentlemen acting as intermediaries between the distributing system and the actual user, for without such mutual confidence and co-operation the most equitable and best-intentioned sets of rules will be rendered a dead letter.

While recognising to the full the ability and integrity of the majority of installation contractors, it is unfortunately true that irresponsible and unreliable persons frequently succeed in securing orders for wiring premises without understanding the full engineering responsibility they assume. It is a lamentable state of things when the possession of a brass name-plate and a printed bill-head is to be deemed sufficient to entitle a person to rank equally with the oldest members of the profession in the eyes of the unsophisticated public.

A stringent set of wiring regulations forms a partial protection by setting a high standard of work, but only partial, for the supply station inspector cannot possibly overhaul concealed carelessness in workmanship and material in every instance, and the art of preparing for the official test is now developed to a fine degree by the cheap wireman.

In my opinion, it is imperative that steps should be taken by all sections of the electrical engineering profession to bring this anomalous injustice before the Board of Trade, and to demand that a system of official registration should be established before any person should be entitled to act as a contractor with respect to premises supplied from public distributing mains, and that such licence to practice should be conditional upon the loyal observance of the standard of work set up by some officially recognised set of rules.

In the meantime, I think there are some points upon which a general agreement may be arrived at between supply authorities and installation contractors, and I suggest the following for your consideration:—

1. That before a wiring contract be accepted application should be made to the supply authority in order that the scope and character of the supply may be mutually agreed upon, with a view to avoid the friction which sometimes arises when the installation is complete before the station is notified, the result being that in some cases an undesirable drop in pressure is manifest, owing to the excessive and unforeseen demand. This is specially necessary in multiple-wire distribution, where the loads on the cables should be as evenly balanced as possible.

2. The supply authority's fuse box should be regarded in its true aspect as being essential for the protection of both the consumer and the general system against accidental disturbance or misuse of the supply, and should never, under any circumstance, be interfered with by other than the authorised officials of the station. To this end the consumer's main fuses should be of lower carrying power than those provided by the supply authority, and should never be increased without first having received the official assent and being notified that the authority's fuses have been proportionately strengthened.

3. That in the process of wiring it should be agreed that the consumer's main switch should be fixed next to the supply authority's fuse box, followed by the consumer's main fuses, and that contractors should carefully arrange that provision is made for the meter being placed in a dry accessible position, where it will be reasonably secure from accidental damage, and enable the consumer to conveniently check the readings when he desires to do so.

4. That in the selection of the insulating covering of the wires and cables more attention should be paid to securing a lasting quality of material than an abnormally high insulation test, as the latter test is not a guarantee of permanence in all cases.

5. That under no circumstances should "combination" gas and electric light fittings be used, even with the so-called "insulating socket."

6. That no wood casing be used under flooring, or anywhere, except for surface work, and that no fuses should be concealed or placed where they cannot be easily inspected and renewed. If fuses are to be regarded as a protection at all, they must not require the use of ladders to get at them, or it will be found that the fuse will be so strengthened in order to avoid the trouble of renewing, that its protective powers will be destroyed.

7. The question of current density, or drop in volts allowable, should, I think, be looked at in a broader sense than is sometimes done. An excessive drop gives dissatisfaction to the supply station and the consumer, especially when the lamps have been in use for 300 or 400 hours, and I scarcely think the small saving effected in the average installation is worth the annoyance that always results; and if it were pointed out to the consumer that this initial saving entailed a perpetual waste of energy, he would probably be the first to object. With a properly designed system of distributing centres, much trouble may be avoided, and I strongly recommend that the maximum drop should not exceed 1 volt, under ordinary circumstances, where the lighting is fairly dense. Where long, narrow rooms have to be wired, and the supply terminals are brought in at one end, a better average pressure will result if the main cables are carried to the centre of the run, and the lamps fed backward and forward from this point.

8. The wiring for arc lamps should be on a liberal scale as to current density, as, owing to occasional failures in the lamp mechanism, the cables may have to carry heavy increases of current for a time, which, without actually causing immediate faults, must certainly have a deteriorating effect upon the insulating material, and it is advisable to enclose the leads for arc lamps, motors, and similar variable current-consuming devices, in iron tubing, or other non-inflammable conduit. Where devices for reducing the supply pressure are necessary, transformers are much to be preferred to choking coils, being more efficient, less liable to give trouble, and more easily adapted to give a uniform distribution of energy to several circuits.

9. It should not be permitted to instal motors of over ½ H.P. unless provided with properly-designed and effective starting mechanism, so that the motor cannot be switched on or off, except through resistance coils. These should be quite independent of any regulators for permanently altering the speed of motors, as the latter, having to be in circuit for long periods, require a larger margin of safety with regard to the maximum temperature rise allowable.

In conclusion, I desire to emphasise the necessity for the generating and distributing plant being kept in as full use as possible, if it is desired that the public should be able to procure a supply of electrical energy at a low price, or to use the usual term, the "load-factor" of the station must be as high as possible.

Engineers and contractors may do their utmost in designing and constructing the most perfect engineering installation, but the price at which the energy can be sold mainly depends upon the nature and duration of the demand.

This is quite obvious when it is considered that 80 per cent. of the cost of production and distribution is incurred in the "stand-by charges," or the amount necessary to keep the mains charged with energy, ready to be drawn off at the consumer's will, and that the "running," or production cost of continuing to supply the actual demand is only the remaining 20 per cent. of the total cost, so that the longer a consumer keeps his lamps in use, the lower is the cost to the station of supplying him.

In order to guard against serious loss in the case of undesirably short use of the supply, it is generally arranged that the maximum demand of each consumer for one hour daily is charged at the highest price per unit that is allowed by the provisional order, which is, in the majority of cases, 7d. per unit, and all consumption after the first hour's use is charged at a much lower rate, varying from 3d. to 1d. per unit, and the resultant average price for varying number of hours' use daily very fairly agrees with the actual cost of production.

To secure the full benefit of a sliding scale is sometimes a puzzle to the average consumer, who is apt to regard electric light as a luxury, and, as such, confines its use to the shop windows or the principal dwelling rooms, and considers it would be too expensive to use in basements or dark places, where gas flares away during long hours, not being aware of the fact that 10 lamps burning for 10 hours a day can be supplied at a much lower cost than 100 lamps in use for only one hour a day, although the total consumption of energy is the same in both cases.

This subject has been so fully treated in Mr. Arthur Wright's recent paper, that I will confine my remarks to pointing out the great opportunities open to installation contractors, when surveying the premises of intending consumers, of pointing out the advantages of using electric lamps in place of gas in those parts of the premises where artificial lighting is required for long periods, and thereby assisting the consumer to reduce the cost of lighting in parts where it is only required occasionally, or for short periods daily.

The problem of arranging a consumer's installation is generally regarded as a simple matter, but, in my opinion, after 21 years' experience, it demands considerable ability and technical knowledge to carry it out upon the most efficient and economical lines.

THE GERMAN ELECTRICAL ENGINEERING INDUSTRY.

The Continued Decline in Dividends.—Future Prospects Uncertain.

The continuation of the general industrial depression in Germany is still reflected by the financial results of the numerous electrical undertakings engaged in the manufacturing branches in that country. This is demonstrated either by a reduction in the amounts of the dividends or by the schemes of reorganisation which have been rendered necessary in consequence of the mistakes of the past, unless further company liquidations are to take place. Even the consumption of copper shows the course of the economic decline, as the total quantity used amounted to 89,548 tons as compared with 116,900 tons in 1900, 102,618 tons in 1899, and less in previous years. The actual consumption for electrical purposes is estimated at 28,000 tons against 43,000 tons in 1900. Some of the German electrical companies have entertained sanguine anticipations respecting the application of electric traction to the working of railways in the near future; but their expectations have been somewhat damped by the announcement recently made by the Minister for Railways that as a result of the operation of the experimental electric train on the Wannsee railway, it has been found that the system is too costly! It appears that the train has been sandwiched between trains hauled by steam locomotives, which are reported to travel as slowly as possible. If this be correct, little wonder need be manifested at the failure of the electric train, which affords a striking contrast to the high-speed trials on the military railway between Zossen and Marienfeld, because it cannot have been given a fair test under the circumstances. Nevertheless, the train on the Wannsee line is to be subjected to further experiments; but if the same conditions prevail in the future as in the past, the results will probably be equally discouraging.

The Union Electricity Company, of Berlin, which had a capital of £150,000 in 1896, increased it to £900,000 in 1898, and £1,200,000 in 1900, at which amount it remained last year. Having been successful in paying dividends at the rate of 12 per cent. in each of the three years which ended in 1898, the distribution declined to 10 per cent. in 1899 and 1900, and a further diminution to 6 per cent. is indicated in the report which has just been issued for 1901. The reduction in the dividend is mainly attributed to the depreciation of the value of the company's investments; but as these are booked at £509,500, as compared with £529,500 in 1900, another explanation would appear feasible. For instance, the gross profits earned last year amounted to £179,100 as against £260,706 in 1900, being a diminution of £81,606, notwithstanding that the expenditure only increased by £1,100. After providing £48,403 for depreciation as compared with £54,873 in 1900, the net profit of £75,000 as against £139,780 allows of the payment of a dividend of 6 per cent., the balance forming the remuneration of the directors and the carry forward. Although the amount written off for depreciation is less than in the previous year, it represents 2 per cent. on buildings, 20 per cent. on stock, 25 per cent. on tools, 50 per cent. on transmission appliances and utensils, and the whole of the cost of accessory tools, patterns, establishment furniture, &c. The company's report mentions that the machinery equipment of the works was further improved during the year, which facilitated the development of new types of direct and alternating current generators, and the works were well employed throughout the twelve months. Among other machinery, the company constructed dynamos and motors of a total output of 126,030 H.P. as compared with 98,000 H.P. in 1900, and 96,300 H.P. in 1899; and 1,071 motor cars were delivered as against 1,062 cars in the preceding year, whilst orders for 663 motor cars are already in hand for the current period. The report refers to the delivery of a 1,000-KW. direct current generator for Sheffield, and states that rotary current plant of 7,500 H.P. is being built for the Brussels Tramways, and a generating station of 5,000 H.P., together with 250 motor cars, is

being equipped for the Anglo-Argentine Tramway Company at Buenos Ayres. Other large orders are being executed for tramways, power transmission, and mining works, and the report therefore characterises the prospects for the present year as satisfactory.

The Allgemeine Electricitäts Gesellschaft, of Berlin, is reported to have formed a company with a capital of £25,000, which is eventually to be increased to £250,000, for the purpose of rendering financial assistance to patentees in the development of their inventions. It also proposes to constitute an electric supply company in Vienna, with a capital of 500,000 kronen, which may be advanced to 1,000,000 with the sanction of the shareholders. The object of the new company is to organise the sales branch of the A.E.G. in Austria. The exploitation of the Slaby-Arco system of wireless telegraphy, which has been undertaken by the Berlin company, has resulted in the receipt of orders from the United States Navy Board for the supply of two double sets of apparatus, which are to be tested both on land and at sea. In this manner the system, which has been tested with satisfactory results in competition with the Braun method at Kiel, will be brought into rivalry with the Marconi appliances in the United States. The company has also paid £15,000 for a license to manufacture turbines. This apparently relates to the Parsons system, for the working of which a German company was formed several months ago, although, in this case, the turbines are to be constructed exclusively for marine purposes.

The Schuckert Company, of Nuremberg, which passed its dividend for the financial year 1900—1901, announced towards the end of March that it was not in a position to give any definite information concerning the working results for the current period; but that in view of the general economic situation, the course of business may be regarded as satisfactory. This statement is apparently intended as a reply to a recent rumour that no distribution will be made for this year. As far as the negotiations with the Allgemeine E. Gesellschaft, of Berlin, for the establishment of a community of interests, or the amalgamation of the two undertakings are concerned, representatives of the Schuckert Company have now returned the visit of inspection paid a short time ago by officials of the A.E.G., and have obtained the information desired respecting the Berlin works. Notwithstanding the various rumours relating to the position of affairs, including the report that the fusion of the two companies is contemplated, on the basis of an exchange of seven shares of the Nuremberg Company for five shares of the Berlin Company, it appears that the scheme, whatever form it may eventually assume, is still in a preliminary stage. Whilst referring to the Schuckert Company, it should be mentioned that the Reichsgericht has just settled an important patent action concerning alternating electricity meters. The nominal parties to the proceedings were Raab and Belfield, but the real owners of the patents in dispute are the Schuckert Company and the British Westinghouse Company. The judgment of the Reichsgericht is that the Belfield patent is dependent upon that of Raab, and as a consequence, the British Westinghouse Company is prevented from introducing into Germany any Shallenberger meters of the alternating current type which are made either in England or the United States.

The first annual report of Hartmann & Braun, of Frankfort-on-Maine, whose business was formed into a company last June under an agreement which became operative as from the beginning of January of the same year, refers in detail to the constitution of the company, which has a share capital of £85,000 and a loan debt of £35,000. It points out that, owing to the unfavourable situation of the electrical engineering industry, the extent of the company's business of manufacturing magnetic and electrical measuring instruments was less than under the former ownership in the previous year, and that reductions in prices were necessary in some respects without the possibility of lowering wages. The working profits amounted to £46,211, and the net profits to £10,955. It is proposed to make a distribution at the rate of 8 per cent. on the share capital for the year. During the period the company, apart from foreign patents, obtained 12 German patents and registered 43 trade marks, whilst applications have been submitted in regard to 19 other proposed patents. These inventions refer partly to apparatus which has become necessary for the electrical industry, and the directors expect to find compensation in them for the decline in the sales of existing manufactures.

The Bergmann Electricity Works Company, of Berlin, has a capital of £425,000, of which £125,000 consists of partly paid shares. It is proposed to distribute for 1901 a dividend at the rate of 17 per cent. on the fully paid shares amounting to £300,000, as compared with 23 per cent. in the previous year, and 8½ per cent. on the other shares. The year's operations resulted in a gross profit of £99,150, as against £99,753, and after writing off £22,476 for depreciation, as compared with £21,688, and making other allocations, the net profit allows of the payment of the before-mentioned dividend. The report states that the company has been successful in the first instance in the action brought against it by a shareholder in regard to the scheme of amalgamation and increase of capital which was sanctioned at the last general meeting. As the action has not been finally decided, it is still impossible for the company to offer the new shares to the former proprietors of the old Bergmann Company, although the dividend on these shares will be paid to them when the right of subscription is exercised in due course.

The report of the Voigt & Haeffner Company, of Frankfort-on-the-Maine, which was converted into a limited company two years ago, with a capital of £100,000, is far from being satisfactory. It states that as a result of the economic re-action, the competition between manufacturing firms became intensified, and under-selling took place among installation companies, with the result that the business of the company largely diminished. The gross profits from manufacturing operations reached £19,908, as compared with £27,771 in 1900, and the net profits amounted to £3,454 as against £11,918. It is proposed to pay a dividend at the rate of 3 per cent., being a decline of 5 per cent. as compared with the preceding year. The report does not give any information concerning the future prospects of the undertaking.

The Busch Electric Car Works Company, of Hamburg, which suffered heavily from the collapse of the Dresden Credit Anstalt and the Kummer Electrical Company over a year ago, has carried through the scheme of reorganisation which was sanctioned at the last general meeting, when a dividend at the rate of 4 per cent. was declared. As now constituted the company has a capital of £156,200, and the manufacturing profit for the year amounts to £3,676. This sum, together with the additional payment of £50,000 provided by the shareholders, the absorption of the reserve fund of £9,706, and other items, has enabled the company to write off £20,000 for depreciation of securities and £19,400 off the debtor account, but, as will be understood, no dividend payment is possible for the past year. As to the course of business in the present year, the company states that the position of the undertaking is such that if the slight improvement noticeable in all its branches continues, an acceptable result may be expected from the economic method of working to which special attention is being devoted.

The report of Max Schorch & Co., of Rheydt, states that the results for 1901 were considerably less favourable than in the previous year, in consequence of the rapid fall in the prices of raw materials, especially in regard to copper and iron, although the stocks of manufactures were also reduced from the beginning of the financial period. After providing £3,243 for depreciation, there remains a net profit of £5,623 for the year, as compared with £8,191 in 1900, and out of this a dividend is proposed at the rate of 5 per cent., as against 8 per cent. in the preceding year. The report mentions various central stations which have been, or are being, equipped by the company, and this fact, combined with the orders received from industrial works, is expected to lead to satisfactory results in the future, notwithstanding the depression in prices.

The Voltohm Electricity Company, which has now removed from Munich to Frankfort-on-the-Maine, closed the year 1901 with a deficit of £4,302. It was proposed by the directors to extinguish the deficit by reducing the capital from £37,500 to £30,000, but the shareholders have refused to approve the arrangement on the ground that it is preferable to await the development of the business during the present year. The report states that a considerable sum had to be written off the stocks of copper in consequence of the unprecedented fall in the price of the metal, whilst at the same time the company's sales in the wire and cable department diminished, owing to the general restriction of output which became necessary in the case of the various German works. It is, however, hoped to make this branch of the business profitable in the future.

The Buchner Electricity Company, of Wiesbaden, points out that notwithstanding the general depression, both the extent of the business transacted and the profits increased during 1901, the new railway department having specially fulfilled the anticipations entertained in regard to it. Of the nominal capital of £37,500, the sum of £30,000 has already been paid. The net profits amount to £4,640, and it is proposed to distribute a dividend at the rate of 7 per cent., as in the previous year. The directors announce that the course of business this year is entirely satisfactory.

The directors of the Company for Electrical Industry, of Carlsruhe, whose financial year terminated last June with a deficit of £6,643, have been engaged in the elaboration of a scheme of reorganisation in order to place the undertaking on a sound basis. It has now been decided to reduce the ordinary capital from £100,000 to £50,000 by writing off one-half of the total number of shares, and to make an issue of 5 per cent. preference shares to the extent of £100,000. In the event of £40,000 of the latter not being subscribed by the end of May, the scheme will become void and the company will be liquidated.

THE STELJES TYPEWRITING TELEGRAPH.

Viewed generally, this apparatus does not appear to possess any striking points of novelty; there are, and have been, other instruments of a similar character which have done fairly good work, but have dropped out of use owing to their having been brought out before their time, or to their being mechanically defective. The Steljes apparatus is to outward appearance almost precisely similar to the A B C printing telegraph, designed 30 years ago by the late Sir Charles Wheatstone and Mr. Stroh, an instrument, by the way, which contained certain mechanical movements of the most ingenious and beautiful character, which are fully described in Patent Specification No. 2,172 of 1871. This apparatus never came into extensive use, as it unfortunately did not possess that all-essential mechanical movement, without which no printing telegraph can possibly be successful, namely, the automatic zero setter. Since the invention of the latter, printing telegraphs have come into more or less extensive use, but they have not been employed to any great extent in connection with private telegraph systems.

Mr. Steljes, working on sound mechanical principles, has within the last few years developed an apparatus which although, as before stated, possessing no outward striking points of novelty, is still the best designed instrument of the kind yet brought out. All the working parts have been properly proportioned and compactly arranged, so that high-speed working, combined with certainty of action, have been attained in a very satisfactory way. As in the

Wheatstone-Stroh apparatus, magneto currents alone are employed, no batteries being required.

The apparatus can be used on a telephone circuit, simultaneously with the working of the latter.

As regards long-distance working, it may be mentioned that successful trials were made between London and Manchester on a telephone circuit, composed of 300 lbs. copper to the mile, and on a similar circuit with 400 lbs. to the mile. A further test between

Steljes Typewriting Telegraph.

London and Glasgow, using super-imposing coils, gave perfect telephonic and telegraphic results. In this case a test was also made round the complete metallic circuit—a total distance of some 900 miles.

These tests were all made with the ordinary three-magnet generator, and there is no doubt that by increasing the number of magnets, a longer distance could be attained. For the working of the recorders, only 10 milliamperes of current are required.

The general appearance of the apparatus, which should have a very extended employment, is shown by the illustration above.

A large number of the instruments are in use, and can be hired from the Postmaster-General or the National Telephone Company, who will contract for their maintenance.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1902.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London W.C., and at Liverpool, to whom all inquiries should be addressed.

7,111. "Improved double-pole electrical joint box." J. G. Roy. March 24th.

7,121. "Life-saving guard for electric motor, steam or cable cars." J. Carr. March 24th.

7,125. "Improved electrical ozonising and circuit-breaking apparatus." P. K. Stern. March 24th.

7,149. "Improvements in watt-hour meters." The British Thomson-Houston Company and F. Holden. March 24th.

7,150. "Improvements in methods of forming coils for electrical apparatus." The British Thomson-Houston Company. (J. W. Lundskog.) March 24th. (Complete.)

7,151. "Improvements in electric arc lamps." The British Thomson-Houston Company. (W. C. Fish.) March 24th. (Complete.)

7,152. "Improvements in electrical steering gear." The British Thomson-Houston Company. (M. W. Day.) March 24th. (Complete.)

7,188. "Improvements in means for the control of electrically-driven reversible roller mills." C. Ilgner. March 24th.

7,195. "Improvements in or relating to arc lamps; more especially of the type known as 'projector' arc lamps." C. Oliver. March 24th.

7,201. "An improvement in electrically-lighted portable time pieces." Maffin & Webb, Limited, and W. E. Saunders. March 25th.

7,203. "An electro-magnetic arrangement for turning points at tramway crossings and on the permanent way." J. McKernan. March 25th.

7,207. "Improvements in and relating to the working of electric or other tramway or railway points." W. J. Stewart. March 25th.

7,216. "Improvements in pipes or conduits for electrical conductors." G. C. Hurrell. March 25th.

7,257. "Improvements in and connected with the manufacture of electric conductors for use as leading-in wires or strips in the manufacture of incandescent electric lamps, vacuum tubes, and the like." S. Cowper-Coles and The Cowper-Coles Inventions Development Co., Limited. March 25th.

7,258. "An improvement in holders for electric glow lamps." A. A. Bence. March 25th.

7,260. "Improvements in and relating to electric incandescent lamps and to means for connecting the same in electric circuits." H. J. Leeves-Johnson. March 25th.

7,314. "Improvements in armatures for electric motors." J. W. Haeussler. March 26th.

7,321. "Improvements in electric incandescent lamps." G. Hookman. March 26th.

7,322. "Improvements relating to apparatus for testing telephone, telegraph, and the like lines." A. Eckstein and A. Brooker. March 26th.

7,323. "Improvements in etheric telegraphy." The Scottish Wireless Electric Syndicate, Limited, and W. Jamieson. March 26th.

7,324. "Improvements in etheric telegraphy." The Scottish Wireless Electric Syndicate, Limited, and W. Jamieson. March 26th.

7,348. "Improvements in coin-freed meters for gas and electricity." G. B. Smith and E. W. Smith. March 26th.

7,361. "Improved method of connecting continuous current motors to the supply network on starting." Siemens Bros. & Co., Limited. (Siemens and Halske Aktien Gesellschaft.) March 26th. (Complete.)

7,362. "Improvements in electric locking gear for railway signals." Siemens Bros. & Co., Limited, and L. M. G. Ferreira. March 26th.

7,363. "Improved electrical resistance and the application thereof to a switch." Siemens Bros. & Co., Limited. (Siemens & Halske Aktien Gesellschaft.) March 26th.

7,370. "Improvements in electric cables." J. H. West. March 26th.

7,380. "Improvements in electric arc lamps." F. Proctor. March 26th.

7,385. "Improvements in electricity meters." C. O. Bastian. March 26th.

7,401. "Improvements in and relating to tumbler and other switches and their terminals for electric lamps and power installations." H. Hirst and H. Bevis. March 27th.

7,405. "Improvements in conduits for electric cables and the like." J. Place and Sons and W. H. Place. March 27th.

7,420. "Improvements in and relating to electrical switches." G. Sperryn and W. H. Wood. March 27th.

7,447. "Improvements in electric transmission of power." Otis Elevator Company, Limited. (Otis Elevator Company, Incorporated.) March 27th. (Complete.)

7,477. "Improvements in the means for conveying railways and pipes and electric leads through towns and populous districts." I. A Timmis. March 27th.

7,487. "Improvements relating to systems of electric railways." The British Thomson-Houston Company, Limited, and H. S. Meyer. March 27th.

7,510. "Electric swing top." T. E. Price and T. Price. March 29th.

7,528. "Improvements in electrical switches." J. Tomlinson, H. Lomax and R. Lomax. March 29th.

7,590. "Improvements in or pertaining to electric head wheels." W. P. Thompson. (La Compagnie de Mines de Bruay.) March 29th.

7,592. "Improvements in or connected with telegraph transmitters." P. F. V. Pedersen and J. Timm. March 29th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 1s (in stamps).

1900.

4,157. "Improvements in electric accumulator traction." B. M. Drake and J. M. Gorham. Dated March 5th, 1900. Electric railways and tramways are worked with accumulators in parts where overhead conductors are not suitable. A separate truck carrying the accumulators is attached where required to supply current. This truck may be fitted with seats and a cover for the passengers. 2 claims.

4,168. "Improvements in devices for rapidly transmitting impulses of current." L. Corebotani and A. Silbermann. Dated March 5th, 1900. Apparatus for transmitting impulses to line, &c., putting the line to earth between each such impulse, is constructed with two metal combs having their teeth intermeshing but not in contact. One comb is connected to the battery and the other to earth. A metal style connected to line can be moved over the teeth, as desired, to send the required impulses to line. 1 claim.

4,193. "Improvements in signal devices for telephone system." P. M. Justice. Dated March 5th, 1900. An apparatus for repeating from the called station an audible signal, so that the calling station shall know that the called subscriber's bell has rung. 9 claims.

4,198. "A new or improved time apparatus for making and breaking telephonic circuits." R. de Lamprecht. Dated March 5th, 1900. Relates to coin-freed detent and liberating mechanism for use in telegraph and telephone systems. 3 claims.

4,230. "Improvements in electric gas lighters." H. D. Fitzpatrick. Dated March 6th, 1900. In electric torches for igniting gas, a dry battery, a switch and an incandescing platinum wire, are supplemented by an incandescent electric lamp which serves to illuminate the gas cock and burner while turning on and igniting the gas. 3 claims.

4,248. "Improvements in switches or circuit breakers for high potential electric circuits." British Thomson-Houston Company, Limited. Dated March 6th, 1900. Switches for high potential circuits provided with means for minimising arcing and for safety detaching the operative parts, &c. 27 claims.

4,262. "Improvements in electric batteries and the method for making electrodes therefor." P. A. Newton. Dated March 6th, 1900. Relates to secondary batteries of the kind described in Specification No. 12,809 A.D. 1899, in which the plates intermediate between the end plates of the battery are of different polarity on opposite sides, and the invention consists, firstly, in making these plates of one or preferably of a number of very thin plates of spongy lead, which have been compressed by a platen press until their specific gravity is approximately that of sheet lead. The plates are applied face to face, and are arranged so that the specific gravity increases from the exterior to the interior. The invention also comprises the use of turf as an absorbent for the electrolyte of any primary or secondary battery. 22 claims.

4,269. "Improvements relating to the production of chlorine and caustic soda or other alkaline hydrate, and to apparatus therefor." H. H. Lake (Communicated). Dated March 6th, 1900. Relates to electrolytic means for obtaining alkalies and chlorine.

4,287. "Improvements in telephonic intercommunication systems." W. Aitken. Dated March 6th, 1900. Relates to a direct call or intercommunication system in which each subscriber has a series of jacks corresponding to all the other subscribers, and an answering jack having inner contacts by which the bell is in circuit when the instruments are not in use. The system is described for metallic or single line working with a central battery used for ringing only, or for both ringing and speaking. In a system of three subscribers connected by lines, the bell being attached to the inner contacts of the answering plugs and shunted by a resistance, a double-wound relay is connected at its middle point to one battery lead, the end terminals being connected to the auxiliary jack contacts and the differentially or single-wound inductance respectively. The instruments are put to line either by the relay operated by the calling and replying connections or mechanically by inserting the plug. 8 claims.